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THE AMERICAN GAS LIGHT JOURNAL

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IT is General John P. Harbison, now, by virtue of an appointment from Governor-Elect Morris, naming Mr. Harbison to the position of Quartermaster General of the State of Connecticut. General, we all salute you!

BRIEFLY TOLD.

DEATH OF MR. GEORGE J. MCGOURKEY.—We regretfully report the death, at his late residence, No. 6 East 69th street, this city, on Wednesday, December 14th, of Mr. George J. McGourkey, ex-President of the American Meter Company. Deceased, who refused a re-election to the Presidency of the Company on the occasion of its last annual meeting, although he consented to continue as a member of its Board of Trustees, was at one time very prominent in the banking business of New York. In due course we will prepare some history of his life.

THE PRESENT ATTITUDE OF THE CONTROLLERS OF THE WILLIAMSBURGH GAS LIGHT COMPANY, OF BROOKLYN, N. Y.—While the progress of the movement for a consolidation of the gas interests of Brooklyn, which is now in a very uncertain state, "all along of" Mr. Addicks and other celebrated gas financiers, may not have much interest for our readers as a whole, nevertheless it might be that a few words respecting the situation would be acceptable. Brooklyn, to say the least, is a peculiar place, in that, although it holds close to 1,000,000 inhabitants, it has a larger number of gas companies than it has hotels, and each of the nine gas companies (eight of which are actively supplying gas, and the other—the Equity—is almost ready to do so) now feels that it is the particular key which alone can work the lock of the proposed consolidation box. Apart from any mention of the likelihood of eventual consolidation, and the fact whether or not such consolidation would be a wise move for those directly interested in the shares of the various Companies, our present purpose is to show the difference in the attitude of the controllers of the Williamsburgh Company towards the present shareholders over that assumed by them towards the shareholders of the Company early in the '80's. About that time a man named Rogers, who has since been an oily and potent factor in Brooklyn gas circles, and who has sustained and now sustains intimate relations with certain Standard Oil Company capitalists, made up his mind that it would be a profitable venture if he could secure a good interest in the Williamsburgh Company. The Company was in a strong financial position, and was managed in a conservative way; but so conservative were some of the ruling spirits that their conservatism closely bordered on timidity. Here was the oil man's opportunity. The first move was to threaten opposition, and the mere threat worked splendidly. The second move was to consult with the Messrs. Lake and Willetts, whose combined interests amounted perhaps to 45 per cent. of the Company's capital, and with them to concoct a scheme whereby the weak holders—the small holders, whose aggregate holdings, however, were important—could be "persuaded" to give up a certain proportion of their stock at a ruinously low figure to the parties who were engineering the proposed scheme of opposition. The Company, as said, was doing a good business; in fact, was earning a fair dividend. Hence the stock was strong; but it had to be made weak, and dividends were passed. This had the desired effect, and when the proposed oppositionists put out their simple plan, which was to request that the shareholders turn over to them 40 per cent. of their stock, at the rate of 50 cents on the dollar, they eventually succeeded in securing about 33 per cent. of the shares; but only after much hard work and much oily persuasion. Some of the Directors in the Company, and some of the executive officers, too, were very prominent in

this missionary work, and it is possible that not all of the stock thus purchased was turned into the pool. However, when the nets no longer caught and held anything in the shape of stray shares, the danger clouds were lifted and the Company speedily basked in the bright sun of financial prosperity. To show that the Directors were thoroughly anxious to protect the minority shareholders, we have only to remark that when the embargo was lifted the Company had a very large sum of cash in its treasury. Now that a proposal for consolidation is on, the Directors, including Mr. Rogers, and at least one of the executives, are very anxious that "all may secure profit alike" in disposing of their shares—possibly because the said Directors and executive are a trifle timid over the outcome of whatever deal may be on, since they are not managing it this time. We can well imagine the grim smile that must break over the countenances of some of those who, a matter of 10 years or so ago, parted with 40 per cent. of their stock at 50, read the neat little circular letter lately forwarded by C. W. Blodgett to all the shareholders. Those who surrendered the 40 per cent. are likely to smile grimly, because they cannot fail to remember that those who received that 40 per cent. are the ones who are now so anxious "that all may secure profit alike!" See the point? Mr. Blodgett's neat little circular is as follows:

"Sir—The rumors and reports regarding gas interests in this city, and especially relating to this [Williamsburgh] Company, make it quite probable that some syndicate of wealthy men may attempt to secure control of the stock of this Company. A majority of the stockholders have thought it best to notify all owners of stock to that effect, so that none will benefit at the expense of another, and so that all may secure profit alike.—C. W. BLODGETT."

How truly Christian in spirit that letter is; how honestly human it is, too! And how different from the letters—to say nothing of the tone of the personal exhortations—that were issued and emitted by the executives of the same Company something over a half a score of years back. The main difference, however, seems to be that it was Rogers then, while it is Addicks now; that it was 50 cents on the dollar then, while it is way above par now.

ANNUAL MEETING, SOCIETY OF GAS LIGHTING.—The 18th annual meeting of the Society of Gas Lighting, which was held in this city on the afternoon of Thursday, December 8th, was notable for a large and representative attendance of the membership, and for the genial fellowship that prevailed. The President, in his annual message, reviewed at length the growth and operation of the Society, and complimented the members upon their fealty to its aims and purposes. The annual reports of the officers, which were most flattering in their revealment of the solidity of the standing of the Society, having been disposed of, an election for officers was held, which resulted as follows:

President—Jos. R. Thomas.
Vice-President—Eugene Vanderpool.
Treasurer—William Combe.
Secretary—Fred. S. Benson.
Member of Executive Committee—F. C. Sherman.
Finance Committee—Chas. H. Nettleton, A. B. Slater and H. F. Allen.
Committee on Place of Meeting—D. D. Flemming, A. H. Strecker and H. F. Allen.

The *Committee on Preparation of Papers for the Ensuing Year* (Messrs. Slater, Leach and Sherman) reported the following assignments:

January—Messrs. Coggshall, Turner and Taber.
February—Messrs. Humphreys, McMillin and Smith.
March—Messrs. Strecker, Bradley and Flemming.
April—Messrs. Wood, Prichard, Vanderpool and Hallett.
May—Messrs. Love, Nettleton, Stiness and Lansden.
June—Messrs. Cowdery, Hambleton and Allen.
September—Messrs. Bush, Beal and Wilkinson.
October—Messrs. Stedman, Lamson and Greenough.
November—Messrs. Sherman, Leach and Slater.

The routine business having been terminated, the Society partook of the annual dinner, which was notable for its excellence. Then followed a series of clever speeches, interspersed with reminiscence, anecdote and repartee, which fittingly brought a most enjoyable reunion to a close.

NOTES.—We are enabled to say, on the authority of Mr. C. L. Dealey, of Dallas, Texas, its former Secretary, that the South Western Gas Association has wound up its organization.——Mr. William Tracy, formerly General Manager of the Alton (Ills.) Gas and Electric Light Company, is now in charge at Leavenworth, Kas. Mr. George Beck succeeds Mr. Tracy at Alton.——The City Council at Youngstown, Ohio, is considering an ordinance ordering the Gas Company to reduce its selling rate to $1 per 1,000—a cut of 20 cents. The Company will contest the measure.

A New Recording Pressure Gauge for Extremely Low Ranges of Pressure.

By PROF. W. H. BRISTOL, Hoboken, N. J.

[Read at the New York Meeting (November, 1892), of the American Society of Mechanical Engineers.]

Since describing and exhibiting a sinuous tube recording pressure gauge at the New York meeting of the Society in November, 1889, many of the instruments have been placed in successful operation; but it has been found impracticable to make gauges on the flattened sinuous tube

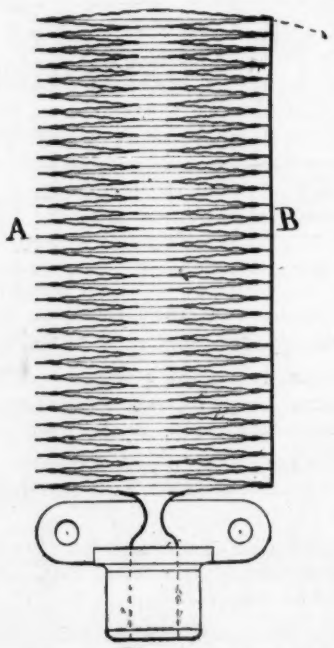

Fig. 1.

principle which would be sufficiently sensitive to register extremely low ranges or variations of pressure. Such are the variations due to a difference of one-tenth inch head of water, as in the case of illuminating gas in street mains, where the total range rarely exceeds two ounces per square inch, or its equivalent, four inches head of water. For such extremely low pressure, it was necessary to offer a very large area for it

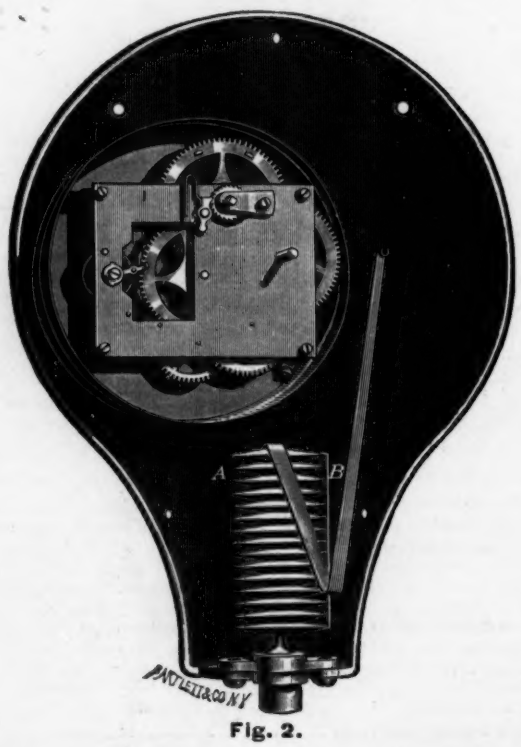

Fig. 2.

to act against. This has been accomplished by employing a series of corrugated diaphragms *A*, placed as shown in cross section in Fig. 1. The diaphragms are arranged in pairs and joined, as shown, with a continuous opening through the line of centers of the different pairs, thus permitting the pressure to exert itself simultaneously on the interior of

every pair, the effect of variations being to produce an elongation of the whole.

This arrangement of diaphragms is employed in the construction of certain self-registering barometers, the small motion of the diaphragms being made available by a train of multiplying mechanism. In the gauge now exhibited, the disadvantage of using multiplying devices is entirely obviated by simply securing a flexible strip *B* along the edges of the diaphragm tube, as it might be called. The effect of applying the flexible strip is two-fold: First, it stiffens the diaphragm tube as a whole; and second, it performs the most important function of resisting the tendency of the pressure to elongate it, which naturally results in producing a greatly multiplied lateral motion.

As in the sinuous tube, the motion thus produced by variations of pressure is ample for directly indicating or recording in connection with a moving chart. By the use of a large number of diaphragms, as shown, it is evident that the change of form of each individual member is very slight for complete range of pressure. It follows that none of the diaphragms will be strained to their elastic limit, and all danger of the gauge taking permanent sets will be avoided. In the application of the diaphragm tube to a recording gauge it is mounted on a back as shown in Fig. 2.

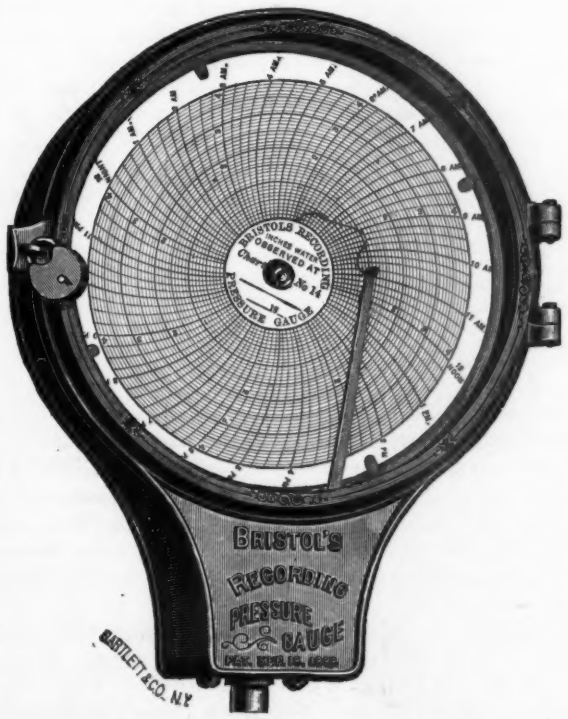

Fig. 3.

A recording pen is attached directly to the end of the diaphragm tube, and a clock is provided, as shown, timed to revolve a dial, in the plane of movement of the pen, once in 24 hours.

In Fig. 3 the gauge is shown complete, with chart, ready for application. The small graduations on the chart indicate tenths of inches head of water.

This form of tube is not limited to recording gauges for light pressures only, as it could be equally well adapted for all ranges if the diaphragms are properly proportioned as to size and thickness of metal.

There are other practical applications of this form of tube, if constructed on a large scale, as considerable motion and power could be developed; sufficient, it is believed, to operate directly, without intervening mechanism, regulators, dampers, valves, and especially that class of automatic devices in which pressure is the initial motive power.

On the Use of Oxygen in the Purification of Coal Gas.

[A paper read by Mr. Harrison Veevers before the Manchester District Institution of Gas Engineers.]

I have for a long time been under the impression that the methods of removing the comparatively small quantity of sulphur from coal gas are on too large a scale, and that they are carried out at too great an expense in proportion to the amount of that impurity. The area of ground covered by the purifier house, and the costly building and apparatus required, seemed excessive. The other impurities, such as tar and ammonia, do not need any such area or elaborate plant for their abstraction; and some time ago, in conjunction with two gentlemen who held similar views, I endeavored to make sulphur removal simpler and less expensive. We erected a washer scrubber, similar to the well known appliance used for removing ammonia, and passed through it gas mixed with a proportion of sulphurous acid gas. But, without entering into details, it proved a failure, although it was successful as a laboratory experiment. I merely mention this to show that, when we required new purifiers, I was prepared to adopt any plan which would lessen the first annual cost. I was attracted by the results of the use of oxygen at Ramsgate and Shrewsbury.

For many years the purifiers at the works under my management were a source of anxiety and expense. Whether through inherent weakness in their supports, or owing to the subsidence of the ground in consequence of colliery operations, the plates of the boxes were continually fracturing—often during the night. Not unfrequently the hydraulic joint would leak, and gas would escape in not inconsiderable quantities. I may here incidentally remark that, though these works have sunk bodily about 12 feet since their erection, no other part of the apparatus has suffered, with the exception that, about a dozen years ago, one of the holders had its columns thrown slightly out of the perpendicular, and the station meter has once required adjustment. This, however, is by the way. Not long ago the danger of explosion by gas escaping from such treacherous purifiers became so serious that I was reluctantly compelled to warn the Board that I could not venture to hold myself responsible for the safety of the works. I therefore advised that a new building and purifiers should be erected; and this was agreed to.

Desirous of adopting the most recent and most successful of improvements in this department of the manufacture of gas, I considered some of the plans for the admixture of air, carbureted or otherwise; but the schemes were rejected—the dislike to admitting the inert gas nitrogen being the principal reason. The oxygen only was required, and not its useless companion nitrogen, which is useful as a diluent for animal and plant life, but worse than useless for combustion, and the more so from the fact that one part of oxygen admitted would have four of nitrogen accompanying it.

The good results following the adoption of the oxygen process by Mr. W. A. Valon, Assoc. M. Inst. C. E., the ex President of the Incorporated Gas Institute, attracted my attention; and, learning that Mr. Belton had the process in work at Shrewsbury, I visited these works by permission, and was satisfied that it was a success. Mr. Belton kindly gave me full particulars of the working, which convinced me there was not only economy in the expenses of labor and of cannel, but in the cost of the purifiers and the house. I found that, to provide for the requirements of the Dukinfield works, for (say) 20 years ahead, six 18 feet square purifiers would be needed, which, with the house, would cost at least £6,000; but, by the use of oxygen, only four purifiers would suffice, at a cost, including the oxygen apparatus, of £4,400. The old purifiers were four in number and 16 feet square.

The main reason for the use of oxygen is that the oxide of iron is revivified in the purifiers, without being exposed to the oxygen of the atmosphere, with its consequent expense of labor in emptying and filling the boxes, and turning over the oxide to get a thorough re-oxidation. But, irrespective of this, there was a more serious matter to be considered. Every time a box was opened there would be a loss of at least 1,000 cubic feet of gas; and, when replaced, an equal quantity of air would either be included or have to be expelled by a similar quantity of gas. In winter, a purifier frequently required changing 10 times a week, entailing a loss of either 20,000 cubic feet of gas, or the inclusion of a quantity of air, which, by diminishing the illuminating power, had to be rectified by the use of a greater quantity of expensive cannel. After mature consideration, I advised the adoption of the system patented by the Brin Oxygen Company, and the Board consented.

A brief description of this method of obtaining a separation and imprisonment of oxygen from the atmosphere may not be superfluous. Air is drawn through a small purifier containing freshly burnt lime, which desiccates the air, and also removes any carbonic acid gas; and, to make assurance still more sure, it then passes through a vessel in which there is caustic soda. Being thus in an almost dry state, the air is forced through steel or iron retorts, set vertically, which contain caustic baryta in a spongy condition, and are heated to a faint red heat (about 1,350° F.). The baryta, when heated and under pressure, has the property of absorbing the oxygen and rejecting the nitrogen, which escapes by means of a valve. It gives off this oxygen when a vacuum is created. This work of alternately arresting and removing the oxygen is performed in a most admirable manner by an automatic machine, which may be worked by steam or else by a gas engine. This machine can be regulated at will to suit the action of the baryta. The pressure

in the retorts is 10 pounds, and the vacuum 13 pounds. After being abstracted from the retorts, the oxygen is forced into a small holder on the Gadd and Mason principle, and thence conveyed to a meter regulated by a valve to admit 1 per cent. of the quantity of gas made. The holder contains an amount equal to one day's demand; but I should advise one of double that capacity, or even larger. The proportion of oxygen in the holder is about 90 per cent.

The removal of the old purifiers and the erection of four more on the same site, without stopping the supply of gas to the town, was no easy matter. On the 22d of June last, two of the new purifiers were fixed, with temporary connections, but without the center valve; and oxygen to the amount of 1 per cent. was admitted at the inlet of the exhauster. These boxes were charged with oxide already somewhat spent; and it was an anxious time for us while we were speculating as to whether or not they would last until the completion of the remaining boxes and center valve. Day by day the gas was tested; but with no trace in the last purifier of the presence of sulphureted hydrogen. Once only, for a short time, were the covers removed, to fix the inlet and outlet pipes to the center valve. On the 20th of October a box was emptied through which 13,635,000 cubic feet of gas had passed; and the two new ones were filled with some partly spent oxide, but how far spent was not previously ascertained. These speedily became foul, and some sulphureted hydrogen passed before a fresh supply could be procured. The oxide from the first box showed, on analysis, the presence of upwards of 65 per cent. of sulphur; thus proving practically to my satisfaction that the oxide could be revivified in the boxes without any of the labor of removing and replacing it. Unfortunately, the town is not provided with a bar photometer; so that the effect of the process on the luminosity of the gas cannot be given. But by the jet photometer, and by visual appearance, the gas now supplied gives a whiter flame. I do not claim that the oxygen is directly the cause of this better light; but it is indirectly, owing to the covers of the purifiers not being removed so often—thereby preventing the presence of nitrogen.

The process has been in use so short a time that I cannot give, in figures, what the financial economy may be; but it may claim to have the following advantages:

(1) Revivifying the oxide saves labor.
(2) It also excludes the admission of nitrogen; and, in consequence of this, less cannel is required to produce the necessary illuminating power.
(3) Increased value of the spent oxide. It is impossible to get the strength of the spent oxide to 65 per cent. without more frequent revivifying in the air, at a greater expenditure in labor than the value of the extra 15 per cent. of the sulphur.
(4) As the oxide abstracts more sulphur, less oxide is required annually.
(5) Greater uniformity in the illuminating power of the gas, particularly in small or medium-sized works.

Experimental Determination of the Heat Generated per Candle Power by Oil and Gas Lamps.

By Prof. D. S. Jacobus, Hoboken, N. J., Mem. Am. Soc. Mechanical Engineers.

In the course of a general investigation, recently undertaken by the Department of Tests, at Hoboken, to determine the relative cost of obtaining the average illumination afforded by gas and kerosene lamps in railroad service, it was proposed to determine the amount of heat generated per candle power with each kind of illuminant, and this element of the general problem was assigned to the writer.

The calculation of the theoretical heat of combustion of the gas and kerosene from their respective chemical analysis is, of course, one solution of such a problem; but it was desired to check the results of such a calculation by a measurement of the heat, after it had distributed itself to the air surrounding the lamp, and supporting the combustion, under as nearly as possible the conditions of a lamp in railroad service.

The determination of quantities of air flowing through any space, by the measurement of velocities with the best forms of anemometers, affords results so unsatisfactory that it was deemed necessary to devise some other method for such measurement. This having been, we believe, successfully accomplished in the present case, it is the object of this paper to describe the method, and also to place upon record, in detail, the measurements of candle power which were necessary to establish the average illumination obtainable from the best forms of kerosene lamps.

The general idea of the method employed to measure the total heat generated is as follows:

The lamp is surrounded with an air-tight wooden chamber about four feet square, with a circular air inlet pipe at the bottom, and another near the top. When steady action is established, the temperatures of the air entering and leaving the chamber were determined by thermometers located at a sufficient number of points, in each of the air pipes, to establish a true average for the entering and exit currents. An anemometer was uniformly moved about the cross-section of the inlet pipe, and the candle power simultaneously determined by a photometer applied by the side of the chamber (see Fig. 1). The lamp is then removed from the chamber, and a steam coil substituted as represented in Fig. 2. The condensation of steam in this coil is adjusted, so that the anemometer and thermometers give practically the same readings as when the lamp was in the chamber. The total heat given by the lamp is then determined from the latent heat of the steam condensed, proper allowance for differences of radiation, effect, etc., being made, as explained below.

It is evident that by this method we avoid having to interpret the readings of the anemometer as absolute velocities. The only means of doing this is to calibrate the anemometer by moving it at uniform velocity through the air, as, for instance, by attaching it to the end of a radius arm rotating at uniform speed. The condition of the anemometer when so calibrated differs so much from those surrounding it, when located in the inlet pipe, that in the present case the amount of air differed 20 per cent., when thus determined, from the true amount as deduced from the heat of the condensed steam, by means of the observed temperatures of the entering and exit air.

The agreement between the heat determined by the condensed steam method and by analysis is as follows:

Heat Generated in British Thermal Units.	By Chemical Analysis.	By Condensed Steam Method.
Per cubic foot of oil gas at 85° F.	1,280	1,250
Total heat per lb. of mineral seal kerosene oil, argand burner	19,000	18,830
Total heat per lb. of mineral seal kerosene oil, double wick flat flame burner	19,000	18,750
Total heat per hour per candle power in B.T.U. — Oil Gas	130	127
Total heat per hour per candle power in B.T.U. — Kerosene	193	191

The candle power measurements showed that the most improved form of argand railroad lamp consumed the same amount of kerosene per candle power as the best form of flat flame lamp, in which two wicks are used with an air supply between them, the combustion of the two wicks uniting so as to form a single flame.

The maximum light which could be steadily maintained, with the attention available in railroad service, with the argand flame, was 16 candles, and with the flat flame, 8 candles.

The oil gas was burned in a four-flame Pintsch burner, affording, under the average condition of railroad service, 32 candles.

The results of the experiments are given in detail in Tables I. and II.

Table I.—*Heat Generated by Gas and Oil Lamps.*

Class of Lamp.	Number of Tests.	Velocity of Air over Car Roof, in Miles per Hour.	Heat per Hour per 32 Candle Power, in B.T.U.		Total Heating Power per Cu. Foot of Gas or per Pound of Oil, in B.T.U.
			Total.	Imparted to Air around the Lamps.*	
1	2	3	4	5	6
Gas	9	0	4,045	.....	1,233
"	10	0	4,084	.....	1,261
"	4	0	.....	3,536	.....
"	3	40	.....	1,847	.....
Oil, argand bur.	12	0	6,278	.....	18,830
" "	11	0	5,971	.....	.....
" "	6	0	5,831†	3,583	.....
" "	5	40	.....	1,942	.....
" "	7	40	.....	2,300	.....
" "	21	40	.....	2,030	.....
Oil, flat flame	28	0	.....	.....	18,750

* The arrangements of the currents of air in the testing box should not be considered as a copy of the currents in a car. The results given in the table simply indicate that the ventilator carries away a great portion of the heat.

† This quantity is not determined by the direct method of measuring the total heat, but is calculated by measuring the heat leaving the ventilator, and adding it to that given up to the air about the lamp. The direct determinations only are employed in drawing conclusions.

TABLE II.—*Rate of Oil Consumption in Argand and Flat Flame Lamps, Two Flames Burned in Each Test.*

Number of Test.	Duration of Test, in Hours.	Class of Flame.	Oil Burned per Hour, in Pounds.	Candle Power, Sum of Two Flames	Oil per Hour per 32 Candle Power, in Pounds.
12	4.5	Argand.	.333	32.2	.331
21	2.0	"	.344	33 5	.329
23	5.0	Flat.	.152	15.9	.306

Description of Apparatus Employed, and of the General Methods of Making the Tests.

The lamps tested were taken from cars in which they had been in active service. Each lamp was suspended from a section of a car roof. These sections were cut from a car that had been in service, and were covered with roofing tin in the usual way.

Two varieties of oil lamps were tested. One of these had argand flames, and the other flat flames. The flat flame lamp had two wicks per burner, between which a portion of the air for combustion was admitted. The gas was burned through a four flame Pintsch burner.

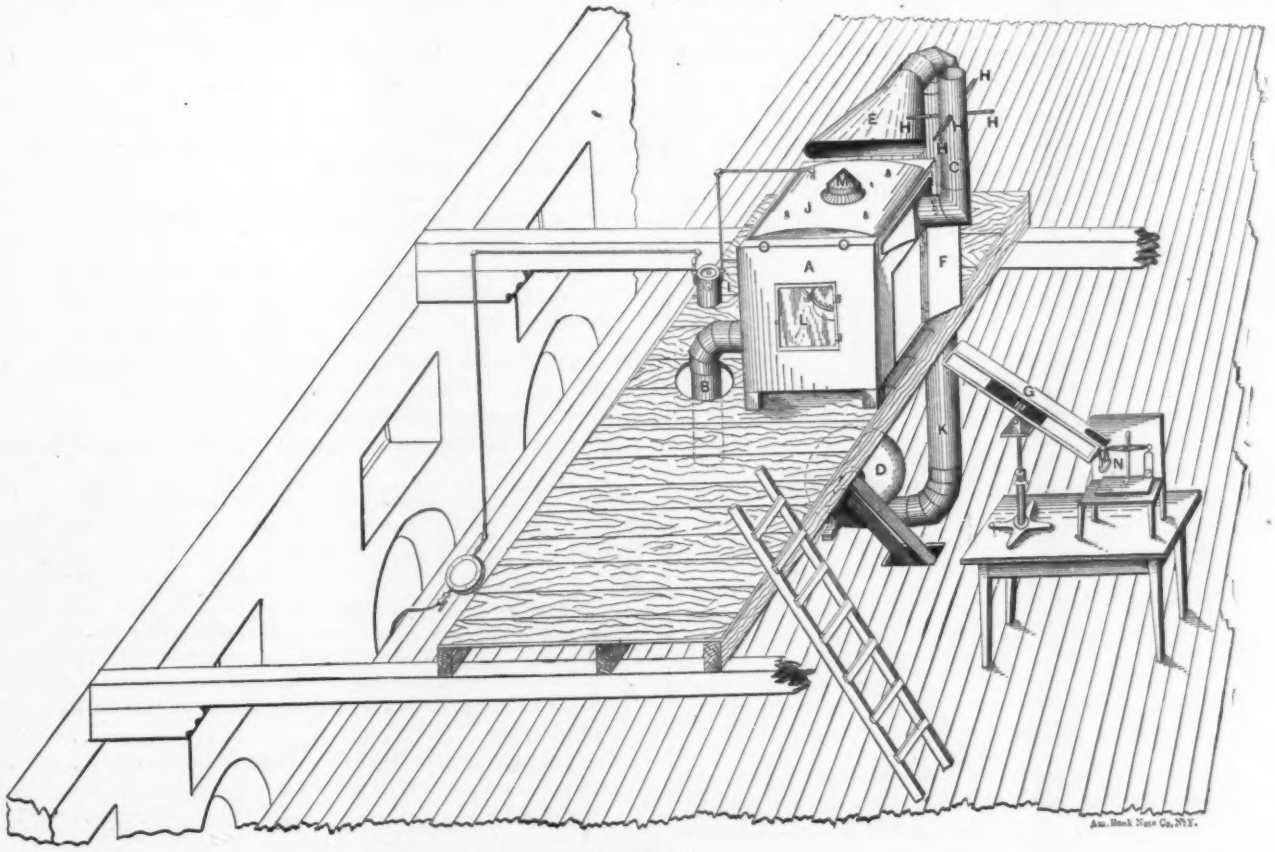

Fig. 1.

The general arrangement of the apparatus is shown in Fig 1. *A* is a box about 4 feet square, in which the lamp to be tested is placed. The top of the car roof section *J*, in all tests except those in which the total heat is measured, projects slightly above the top of the testing box *A*. *L* is a glass door through which the conditions of the lamp flames may be observed, and *F* is a door that is opened when the candle power is measured. In making heat measurements the doors *L* and *F* are closed The air then enters through the galvanized iron pipe *B*, which is 12 inches in diameter, and passes out through the lamp ventilator *M* and the pipe *C*, which is 10 inches in diameter. *H*, *H*, *H*, *H*, *H* are five thermometers used to measure the exit temperature. These are placed so that their bulbs are in various positions in the same cross-section of the pipe. *I* is a meter for measuring the gas used by the gas lamp.

In tests where the effect of the velocity of the air over the top of the car is included, the blower *D* furnishes air through the 12-inch pipe *K* to the nozzle *E*. The blower was made to run at such a speed that the velocity of the air over the ventilator *M* was 40 miles an hour.

The candle power was measured by means of the photometer *G*. *N* is the candle balance.

In the tests the total heat developed by the lamp, four strips, one of which is marked *O*, *O*, in the figure, were removed, so that the air from the box had free access around the edges of the car roof section, and a special cover, which was high enough to clear the ventilator *M*, was placed over the top of the testing box. The pipe *C* was removed from the side of the testing box, and placed on a flange fastened to the top of the special cover. In the tests for total heat, therefore, all the air that entered through the pipe *B* passed out through the pipe *C*.

Anemometers were employed to measure the velocity of the air in the pipes *B* and *C*.

To make a complete heat measurement the lamp is placed in the testing box *A*, as already described, and all data recorded. The lamp is then removed, and in its place is substituted a steam radiator. The radiator is furnished with sufficient steam to heat the air the same amount and produce the same anemometer readings as were observed in the test of the lamp. The heat given up by the radiator will then be same as the heat generated by the lamp, and may be measured by weighing the steam condensed by the radiator. The arrangement of the radiator coil is shown in Fig. 2.

The radiator *J* is placed at an angle so that the condensed steam will flow freely from it. The steam furnished to the radiator is superheated in order that the total heat it contains may be accurately estimated. The Bunsen burner *B* is employed to heat the steam sufficiently to give the desired amount of superheating after passing through a throttling orifice at *E*. The amount of steam entering the radiator is controlled by means of the valve *A*. The gauge *D* gives the pressure of the steam entering the coil. *C* is used to assist in preserving a uniform rate of flow through the orifice *E*. *F* and *G* are thermometers inserted in mercury wells to measure the temperature of the superheated steam at entrance and of the water at exit. The exit water is preserved at a constant height in the water glass *K* by throttling at the valve *L*. In order to prevent loss by evaporation, the condensed steam is led through the rubber tube *M* under the surface of cold water, in which it is finally weighed. In some of the tests the radiator would have been too large for the work if it had been completely filled with steam. In these tests a certain amount of air was left in the radiator, which reduced the rate of condensation to the desired amount.

To eliminate leakage in the testing box shown in Fig. 1, all the joints were carefully glued together. The doors were made a good fit, and after closing them, soft putty was spread over the cracks around them. The cracks at the sides of the movable pieces *O*, *O*, were covered with thick brown paper pasted on with flour paste. The pipe *C* was thickly covered with felting. All the exposed portions of the apparatus shown in Fig. 2 were covered with felting.

In a preliminary test the joints at the sides of the movable pieces *O*, *O*, were not covered with the strips of paper. Although the joints were

well made, the pieces being fitted in place as accurately as possible, the leakage of air through them was found to seriously affect the readings. It was for this reason that every joint in the box in all the tests employed in deducing the heat data were closed by either pasting paper over them, or by means of soft putty.

The method just described is that employed in all the tests, but there are necessarily corrections to be made to allow for variations of the temperatures and anemometer readings in tests with the steam radiator in the box, with the corresponding ones in which the lamps were in the box. Where several lamp tests were made under nearly the same conditions, a single radiator test was made, and the proper corrections applied in reducing the corresponding heat for the lamp tests. The method of making these corrections and details of the experiments will be given later. The arrangements of the currents of air in the testing box should not be looked at as a copy of the currents in a car. They are necessarily introduced to measure the heat, and indicate that the ventilator may be made to take away a great portion of the same.

To measure the candle power at various angles under the lamp, a rotating photometer, devised by Dr. Geyer, was adopted. This is represented in Fig. 3.

A is the photometer which is made to rotate about the shaft *D*. *B* is a mirror mounted at an angle of 45°. The lamp *H* is placed so that the flame center is on the center line of the shaft *D*. The candle power in a horizontal direction is first measured directly by means of a second

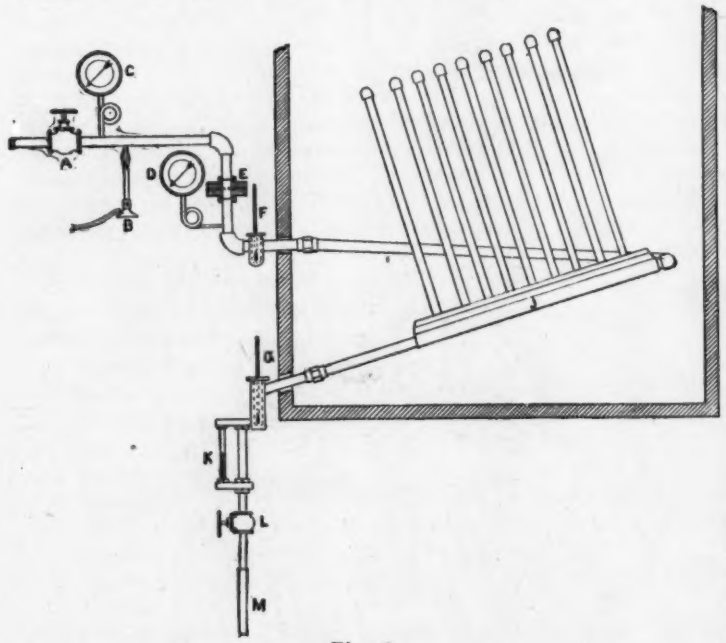

Fig. 2.

photometer *C*, after which the photometer *A* is rotated so that it also measures the horizontal candle power. The difference in the readings gives the loss due to the mirror. After reading the horizontal candle power by means of the rotary photometer, the candle powers at the various angles under the lamp are measured. The desired angles are marked on the pulley *H*. The standard candles for the rotating photometer are placed on a support, fastened on a special piece that is held against the end of the photometer at *F*. They are lifted from the sup port in order to weigh them. The candles used in the photometer *C* remain on a pair of candle balances. The results of the measurements by means of this photometer are given in Tables III., IV., V. and VI.

TABLE III.—*Candle Power at Various Angles, Test No. 24, Gas Lamp.*

Time. P.M.	Candle Power Corrected for Mirror and Rate of Burning of Candle.						
	Horizontal.	15 Deg.	30 Deg.	45 Deg.	60 Deg.	75 Deg.	Vertical.
10.30	39.6	... ...	.....	34.9	34 3	26.4	25.1
11.00	37.2	37.2	33.2	35.9	35.9	23.9	22.6
Midnight.							
12.00	36.1	36.1	33.4	.....	.....	.....	.....
12.25	37.7	37.7	32.5	33.8	35.1	26.0	26.0
Sum ...	150.6	111.0	99.1	104 6	105.3	76.3	73.7
Average	37.7	37.0	33.0	34.9	35.1	25.4	24.6

Average candle power for all positions below a horizontal plane = 32.5.

Ratio of the average candle power to candle power at 45° = .93.

Ratio of candle power in horizontal direction to candle power at 45° = 1.08.

In test No. 8 the relative candle power at 60° and 45° was found to be $\frac{\text{C. P. at } 60°}{\text{C. P. at } 45°} = \frac{31.4}{32.5} = .97$ (see Note), whereas in the above test the corresponding ratio is 1.01. The difference between these quantities is probably due to the fact that that the lamp was placed in a slightly different position in regard to the photometer. The positions of the lamp are shown in Fig. 4.

Note.—The details of this test are as follows:

Candle power at 45°, taken over ¼ hour interval, mean of 5 observations ..... = 32.4
Candle power at 60,° after shifting photometer, mean of 7 observations ..... = 31.4
Candle power at 45°, photometer in original position, mean of 5 observations ..... = 32.6

TABLE IV.—*Candle Power at Various Angles, Argand Oil Lamp, Test 26.*

Time. A.M.	Candle Power Corrected for Mirror and Rate of Burning of Candles.						
	Horizontal.	15 Deg.	30 Deg.	45 Deg.	60 Deg.	75 Deg.	Vertical.
3.00	23.1	18.9	18.9	16.8	10.5	4.9	7.0
3.50	18.2	16.8	15.4	12.6	8.4	4.2	5.6
4.20	19.6	16.8	15.4	11.2	8.4	3.5	5.6
Sum ...	60.9	52.5	49.7	40.6	27.3	12.6	18.2
Average	20.3	17.5	16.6	13.5	9.1	4.2	6.1

Average candle power for all positions below the horizontal plane ..... = 12.5
Ratio of average candle power to candle power at 45°. = .93
Ratio of candle power in horizontal direction to candle power at 45° ..... = 1.50

TABLE V.—*Candle Power at Various Angles, Argand Oil Lamp, Test 31.*

Time. P.M.	Candle Power Corrected for Mirror and Rate of Burning of Candles.						
	Horizontal.	15 Deg.	30 Deg.	45 Deg.	60 Deg.	75 Deg	Vertical.
9.25	26.0	24.7	20.6	19.2	9 6	4.1	6.2
10.30	24.5	24.5	21.9	16.8	9.0	4.5	6.4
10.55	25.5	25.5	22.8	18.1	9.4	4.7	6.0
Sum ...	76.0	74.7	65.3	54.1	28.0	13.3	18.6
Average	25.3	24.9	21.8	18.0	9.3	4.4	6.2

Average candle power for all positions below the horizontal plane ..... = 15.7
Ratio of average candle power to candle power at 45°. = .87
Ratio of candle power in horizontal position to candle power at 45° ..... = 1.41

Candle power at angles above the lamps—

Horizontal.	15° above equal	30° above equal	45° above equal
C.P. 25.5	24.1	20.1	5.4

The candle power readings given in Tables IV. and V. are for one flame, furnished with a white porcelain shade as in car practice. To obtain candle power of lamp with two burners, multiply the results by 2. A supplementary test was made on an argand burner with a slightly larger spreader than those furnished with the car lamp, and having no shade. This test was made by measuring the candle power directly without the use of a mirror. The ratio of candle power at 60° and 45° was found to be 1.40.

TABLE VI.—*Candle Power at Various Angles, Test No. 27, Flat Flame Oil Lamp.*

Time. A.M.	Candle Power Corrected for Mirror and Rate of Burning of Candles.						
	Horizontal.	15 Deg.	30 Deg.	45 Deg.	60 Deg.	75 Deg.	Vertical.
4.45	11.0	11.7	11.7	8.3	6.2	4.1	5.5
5.09	11.0	11.0	10.4	8.3	4.8	4.5	4.8
5.15	10.4	10.4	9.7	7.8	4.8	4.8	5.5
Sum ...	32.4	33.1	31.8	24.4	15.8	13.4	15.8
Average	10.8	11.0	10.6	8.1	5.3	4.5	5.3

Average candle power for all positions below the horizontal plane..... = 7.9
Ratio of average candle power and candle power at 45° = .97
Ratio of candle power in horizontal direction to candle power at 45° ..... = 1.33

The flame was placed at an angle of 45° to the plane in which the candle power was measured.

In the tests of candle power by means of the rotating photometer, as given in Table III., the gas lamp was mounted so that the candle power was measured in the plane *AB* (Fig. 4). In a previous test (No. 8) to determine the relative candle power at the angles of 45° and 60° below the horizontal, by shifting the photometer, shown in Fig. 1, and in all the tests in which the heat generated by the lamp was determined, the candle power was measured in the plane *CD*. Fig. 4 represents the positions of the gas flames in looking downward on them.

Measurement of Candle Power.

A Bunsen photometer was employed. The standard candles were purchased from the American Meter Company. These were compared with a "Sugg" standard candle and found to agree within 1 per cent., which is less than the probable error of observation in candle power measurements. For details of the comparative tests see Table VII.

The candles therefore agreed with each other to within one per cent., which is less than the probable error in observation. Two flames were burned in each set of candles. The photometer scale was graduated for one candle, so that the readings should be multiplied by two to give the candle power developed in the test. This is not done, however, because the readings, as they now stand, give the average candle power for the candle.

Special tests were made to determine the effect of a spark on the ends of the candle wicks. These indicated that if the spark is a small one and does not alter the whiteness of the flame, the candle power, when corrected for the rate at which the wax is burned, is the same as for a candle in which the spark is completely removed. If the spark becomes large enough, however, to cause the flame to appear yellow, the candle power per grain of wax burned will be less than that given by a candle with no spark. The amount of falling off of candle power due to this cause may be as high as 15 per cent.

In the candle power measurements taken during the tests for the heat given off by the lamps, the photometer was set at an angle of 45°. This was found to be about an average of the candle power measured below a horizontal plane passing through the flame center. See Tables III. to VI. In the heat tests, therefore, the candles were at an angle of 45°

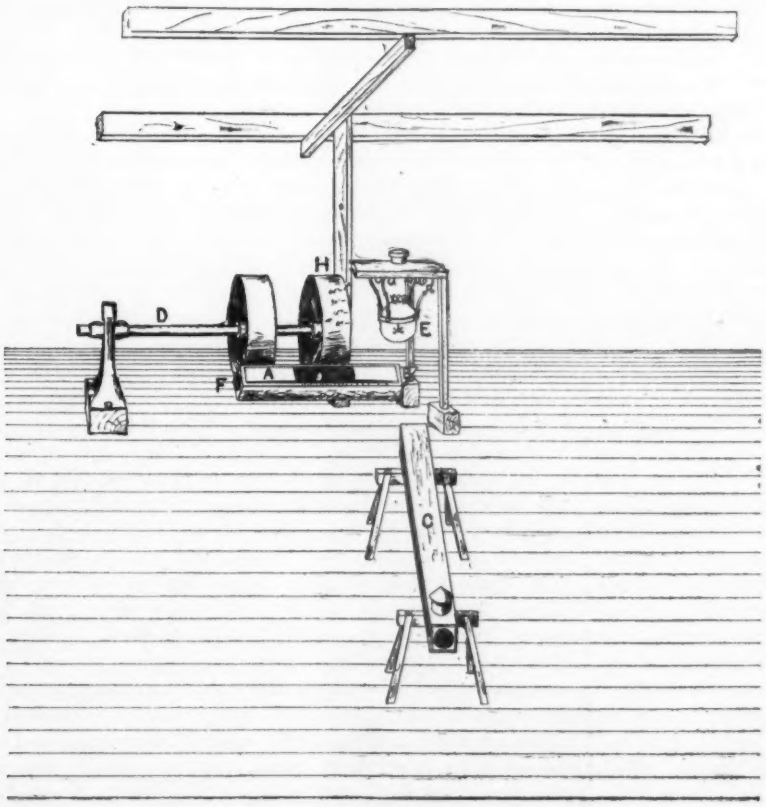

Fig. 3.

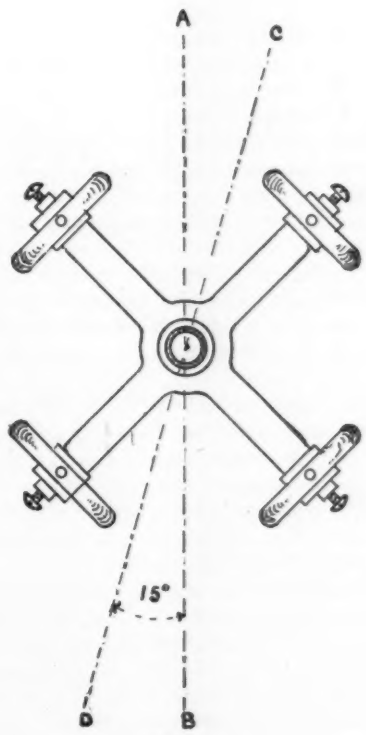

Fig. 4.

TABLE VII.—*Comparison of Candle Power of "Sugg" Standard Candles and the Standard Candles of the American Meter Company.*

Number of Test.	Set of American Meter Company Candles.	Time to Burn 10 Grains of Candle in Minutes and Seconds.		Ratio of Actual Intensity of American Meter Company Candle Power to Unity.	Candle Power of Candles for Readings of Photometer Scales, Am Meter Co. Candles Taken as Standard.		Candle Power of Sugg Candle Calculated from Rate of Burning.
		American Meter Company.	Sugg.		Actual.	Corrected for Ratio of Burning Am Meter Co. Candle.	
1	2	3	4	5	6	7	8
1	A	2.54	2.37	.862	1.10	.95	.96
2	"	2.31	2.47	.993	.90	.89	.90
3	"	2.38½	2.47	.946	.95	.90	.90
4	"	2.42	2.42½	.926	1.00	.93	.92
5	"	2.34½	2.37½	.971	.98	.96	.95
6	B	2.56½	2.40½	.850	1.10	.93	.93
7	"	2.54	2.32	.862	1.14	.98	.99
8	"	2.46	2.44½	.904	.95	.86	.91
9	"	2.39	2.24	.943	1.05	.99	1.04
10	"	2.45	2.31	.909	1.08	.99	.99
11	"	2.41	2.28	.932	1.10	1.02	1.01
Average	.....	.....	.....	.....	.....	0.945	0.954

with the center line of the photometer. In placing the candles in their positions the measurements were taken from the center of the flames.

To prove that the candle power readings taken with the candles at an angle were correct, special tests were made by Prof. Geyer. In these tests he employed the rotating photometer already described and shown in Fig. 3. The candles were placed in the positions which the lamp occupies in Fig. 3. A miniature electric lamp, which was regulated so that the light giver-off was the same color as that produced by the candles, was mounted in the rotating photometer. This lamp was preserved at a constant candle power. The slide in the photometer was set correctly for the horizontal candle power and the photometer revolved quickly to the position of 45°, when the slide was set over again. A number of such experiments proved that the difference in the candle power of the candles at 45° and in a horizontal direction was less than 1 per cent.* Two candles were used in measuring the candle powers of the lamps. These were set 100 inches from the lamp. The rate of burning of the wax was determined by noting, by means of a stop watch, the time required to burn a given number of grains.

The candle powers of the argand oil flames and of the gas flames were measured throughout the heat tests without turning the lamp about its axis. In the argand oil flame care was exercised in adjusting the wick,

* For details of these experiments see *Stevens Indicator*, October, 1892.

so that the flame on the side toward the photometer was of the average height. The gas lamp was set at an angle that was found by previous tests by Dr. Geyer to be the one in which the average candle power was developed. It was concluded by Dr. Geyer that this candle power varied but little throughout the entire circle, so that any error involved by not turning the lamp at various angles in each of the tests was but a small one. The flat flame oil lamp was revolved about its vertical axis through angles of 45°, so that every candle power reading represents an average of eight positions.

[To be concluded.]

An Account of a Recent Explosion in a Tar Well.

[A paper read by Mr. W. R. Chester, before the Manchester District Institution of Gas Engineers.]

I have been asked to lay before you some of the circumstances in connection with a mysterious explosion which recently occurred in a tar well at one of the gas works of the Nottingham Corporation. Unfortunately, explosions in gas works are not of infrequent occurrence. They are, however, generally due to gas itself; and they can, as a rule, be easily traced to some simple yet well defined cause, which upon investigation leaves little doubt either as to the composition of the explosive mixture, or how the same came to be ignited. In the explosion now under consideration, both the composition of the mixture and the mode of ignition are involved in mystery; and it is partly on this account, and because of the rarity of such an explosion, that I have considered it of sufficient importance to receive the consideration of this Institution.

The tar well is constructed below ground, at one end of a large block of buildings containing the engine house and two sets of purifiers in the central portion, with a revivifying shed at each end. Above these sheds are store rooms; and below, at one end, there is the tar well, and at the other end the liquor well of similar dimensions. The tar and liquor are divided in a separator, and each passes direct to its respective tank. The tar well is 68 ft. 11 in. long by 29 ft. 8 in. wide and 9 ft. 2 in. deep, having a cubic capacity of 18,741 feet, or about 117,000 gallons. It is constructed of brickwork in cement, and covered with arches supported on cross walls; the floor above being finished in York flags. The store room floor is carried on cast iron columns 16 ft. 9 in. high, resting on piers built in the tanks, and is of fireproof construction. There were eight manhole openings into the tank, each about 2 feet square, and each somewhat imperfectly covered with timber. The tank was full, to the springing of the arches, with tar, having a covering of perhaps 3 or 4 inches of liquor on the top; and there was therefore only the space afforded by the crowns of the arches for a gaseous explosive mixture to accumulate in. Two longitudinal intersecting arches formed a communication with the whole of the spaces above the tar. There were two inlet pipes (we will call them A and B), which entered above the level of the tar, and a suction pipe, dipping, of course, to the bottom of the well. The inlet pipe A, 8 inches in diameter, is from the separator; and the other, B, also 8 inches in diameter, is a drain pipe leading to a siphon 120 feet away. The end of the drain pipe is open, and the tar, which accumulates in a siphon on the inlet of the exhausters, is pumped into it at stated periods. The open end is about 10 feet from a boiler furnace. On the floor above the tank was some oxide of iron in process of revivification; and at the time of the explosion there was no known light nearer than about 50 feet away.

The explosion took place at seven o'clock on the morning of the 10th of July this year—a Sunday, when all the men were away, with the exception of about half-a-dozen who were retained for feeding furnaces, etc. The nearest man at the time of the explosion was the boiler furnace man, who was about 120 feet away. But another man had passed through the shed only five minutes before; and he noticed nothing unusual which would in any way account for the accident. The explosion was sharp and sudden; and it was followed by rumbling sounds heard some distance away. No fire followed; and only a little dust was perceptible. The effect of the explosion was to burst up the whole of the arches and floor covering the tank, and to cause them to tumble into the tar. The floor above was lifted, and the necks of several of the columns were broken; but only one column fell, and the floor remained, though in a somewhat unstable condition. No one was injured, and no further damage was done, though the outer wall appeared to have been lifted bodily upwards, commencing at the top of a stone string course, and was afterwards set down again, projecting 1½ inches outwards beyond its proper position.

As to the cause of the explosion, there are several possible explanations; but nothing of an absolutely conclusive character has yet been discovered. Wilful intent or malice may be dismissed without a second consideration, as there is no evidence to indicate, or even suggest, this as a possible cause.

The combustible of the explosive mixture may have been gas, or it may have consisted of some volatile hydrocarbon vapor from the tar. If the latter, how came it there? In the first place, the temperature of the tar was not higher than 70° F.; while the first drop of benzole, its most volatile product, cannot be obtained at a lower temperature than about 80° C., or 176° F., which is more than 100° F. higher than that at which the tar stood in the well. Secondly, it must be remembered that there was a body of liquor about 3 inches thick floating over the surface of the tar; thus cutting it off entirely from contact with the atmosphere, and forming, one would suppose, a sufficient barrier to prevent absorption. I do not, therefore, think the combustible in the explosive mixture can have been a tarry vapor. If the combustible was gas, the question again arises: How did it get there? On examination of the walls after the tank had been emptied, they were all found to be sound and free from crevices; and no leaks from the neighboring pipes or vessels could be discovered. Supposing a leak to have existed in the adjoining purifier house, it is impossible to conceive that the gas could have descended through the manholes into the tank below, when it had free exit in every other direction.

One other theory remains to account for its presence; and this appears to be the most likely explanation of all. Was the gas carried into the tank by mechanical admixture with the tar, and, on settlement, afterwards set free? Some experiments I have recently been making lead me to this conclusion.

At these works it has been customary to scrub with large volume of liquor; and when investigating a few weeks ago, I found the liquor to be passing the scrubbers at the rate of 1 volume for every 137 volumes of gas, which is equivalent to about 475 gallons per ton of coal carbonized. From the liquor in the seal box, close up to the scrubbers, it was noticed that numerous bubbles of gas were constantly rising to the surface; and a simple test showed that these were coal gas, which was escaping at the rate of 390 cubic feet per square foot of surface per 24 hours. A similar test applied to the separator, some distance away, gave an escape of 4 cubic feet of gas per square foot of surface per 24 hours. A third test applied to the liquor in the well, about 3 feet away from the inlet pipe, gave an escape of rather more than 1 cubic foot of gas per square foot of surface per 24 hours. A fourth test at the opposite end of the well showed no escape of gas; thus proving that all the gas carried into the well by the liquor in a state of mechanical suspension had afterwards been set at liberty. Now, as the depth of the well is about 10 feet, and assuming it to be half full, and also assuming that the liberation of gas is going on at the rate of 1 cubic foot per square foot of surface per 24 hours over half the area of the well, it will be seen that a violent explosive mixture, in the proportions of 1 volume of gas to 10 volumes of air, may at all times be anticipated to exist.

At the time of the explosion, the well was nearly nine-tenths full of tar, and there was therefore not more space than about 1½ feet in depth for the explosive mixture to fill; and if it were composed of 1 volume of gas to 8 volumes of air, it would only require an escape of one sixth cubic feet of gas per foot of area per 24 hours to form a disastrous explosive mixture. In the separator, both tar and liquor mingle when first entering it, and it is only fair to suppose that the tar will carry off, in a state of mechanical suspension, at least a portion of the gas brought to it by the liquor flowing from the scrubbers, and that it will afterwards set it free when at rest in the well. This I consider to be the most probable explanation of the presence of the explosive mixture.

We have still to account for the ignition. The explosion took place in broad daylight. There are three possible explanations of the mode of ignition: (1) It may have been due to the tossing of a lighted match, or the throwing of the ashes of a tobacco pipe, through one of the openings in the wall, by some careless and thoughtless passer by. But against the probability of this explanation there is the fact that a stringent regulation against smoking is enforced at all the works; and, moreover, if ignition were due to this cause, it would probably have immediately followed after the light, and thus involved the guilty party in the wreck. (2) Ignition might have been due to the spontaneous combustion of spent oxide lying on the floor above, in process of revivification. But against this there is the fact that a man passed through the shed only five minutes beforehand, and he could not have failed to notice fire if it had existed. (3) Ignition may have been caused by the firing of gas in the drain pipe B, which has its outlet near a boiler furnace, though 120 feet away from the well. If so, the fire must have run back along the pipe to the well, and thus ignited the explosive mixture therein contained. Against this, which I consider to be the most likely explanation of the ignition, we have the fact that the boiler man

had not commenced to clinker out, and the end of the pipe was at least 10 feet away from the fire in the boiler furnace.

As gas engineers, we have to consider what are the practical lessons taught by such an explosion, and to determine what steps are necessary to be taken in order to render the recurrence of such explosions impossible. For my own guidance in the future I have laid down the following rules:

(1) The scrubbing plant should be of the highest efficiency, so that the ammonia purification may be effected with the smallest possible quantity of liquor.
(2) There should be a small receiver into which the liquor or tar should flow prior to entering the store tank, in order to give an opportunity for the separation of gas held in mechanical suspension.
(3) All pipes entering the store tanks should be carried to within a few inches of the bottom of the well, so as always to be sealed.
(4) All manholes should be made of cast iron frames having sealed covers.
(5) The manhole covers must not be removed except during daylight, and no artificial light is on any account to be brought near when the covers are off.

If such practice is adhered to, I have every confidence that, in the future, we shall have no reason to anticipate explosions in either tar or liquor wells.

Protection of Exposed Water Mains Crossing Bridges, Etc.

[A paper read by Mr. Stephen E. Babcock, before the American Water Works Association.]

I think it will be generally conceded that frozen mains and services are one of the most annoying accompaniments of the winter months in our northern latitudes.

Adequate fire protection demands that frozen mains be put in order at once and at any expense.

The distribution systems of mains in most all water works require that some, or many water courses, or rivers, be crossed, either underneath the bed or over bridges. Many under crossings are difficult of original construction, and sometimes uncertain as to permanency, while an overhead bridge crossing is always accessible if leaky, the defects are apparent at once, and are only liable to the one objection of freezing.

In designing the Little Falls (N. Y.) water works system I found it necessary to make four crossings, three over water courses (the largest one, the Mohawk River), and one overhead railroad crossing. In all these cases an under crossing was entirely impracticable.

Desiring to use the best and most serviceable non-conducting material, I examined various works in which the subject of non-conducting materials is mentioned. I found that all the tests are based upon the radiation of heat from steam pipes, and not a single author gives any data upon natural temperatures in cold pipes. Steam means a vapor of water heated up to a normal or sensible temperature of 212°, or the boiling point, and a surplus of about 966 degrees of latent heat, which freeing itself produces the desired heat or warmth through radiation from the pipes containing or transmitting the steam. This condition is entirely different from the case of a water main. Water in a main in winter is about the the temperature of 50° F., while the freezing point is 32°. The water may be kept fluid so long as the temperature in the main does not fall below 36° or 38° F. The temperature of steam being so high, all non-conducting materials used in connection with it must possess, in addition to the qualification of non-conducting properties, also an element of non-combustibility—while the non-combustible properties cut no figures with a water main. I found that Haswell, in the well known Mechanic's and Engineer's Pocket Book, gives the relative non-conductibility of materials, based upon hair felt at 100, as follows:

Hair felt, 100; mineral wool No. 1, 83.2; sawdust, 68; mineral wool No. 2, 67.5; charcoal, 63.2; pine wood, 63.2; loam, 55; lime, slacked, 48; asbestos, 36.3; coal ashes, 34.5; air space, 2 in., 13.6.

In volume 5 and 6 of the Proceedings of the American Society of Mechanical Engineers will be found a very elaborate paper on the subject of non-conducting coverings for steam pipes, prepared by Prof. John M. Ordway, Boston, Mass. He arranged the various materials in order of efficiency as follows: F. heat units 1 sq. ft. 1 hr., glazed cotton wadding, 47.7; wool wadding, 81; slag wool and straw board, 90.51; live geese feathers, 96.4; hair felt, 102.3; calcined magnesia, loose, 123.6; cork charcoal, 126.5; pine charcoal, 136.6; washed fossil meal, loose, 145.1; plaster of Paris, 309.4; extremely fine sand, 317.5; air space, 479.9; fibrous asbestos, 489.8; coarse sand, 620.7; fine sand, 623; naked pipe, 1555.10.

In the course of the discussion over Prof. Ordway's paper, Mr. E. D. Leavitt, Jr., then President of the Society, stated that when he became connected with the Calumet and Hecla mines in 1874 it was then the custom in carrying steam pipes under ground to excavate a trench, place the pipe and then shovel the dirt back; the condensation was enormous. The defect was remedied by applying a coating of plaster of Paris and sawdust, mixed in the proportions of one part plaster of Paris to two parts of sawdust. The plaster and sawdust were mixed as you would ordinary mortar and put on 2½ inches thick. While the covering was wet the condensation was heavy, but when it once became dry the condensation was less than 1 per cent. of the former loss, being about 5 per cent. total loss by condensation. The idea was obtained from a boiler covering used at a fair of the Franklin Institute in 1865. Prof. Eggleston, School of Mines, Columbia College, also mentioned the fact about the bridge of Grenoble, which was built in the year 1626, and was destroyed by fire in 1837 (an interval of 211 years), that all the iron surrounded by mortar was found to be intact and just as bright when taken out as it was when the bridge was built. On the contrary, that which was not so surrounded, or where there was an air space, was very much rusted.

These two facts struck me very forcibly as to a possibility of combining both, with a view of protecting water pipes from loss due to radiation of heat and oxidation, or rust. I at once conceived the idea that it was practical to whitewash over with Portland cement a water main laid in a shoal trench, then cover it with 3 to 4 inches of plaster of Paris and sawdust, apply an outside thin coating of cement mortar, producing a covering, when dry, that would be a preservative to the iron, a good non-conductor of heat, and, what is very desirable, at a reasonable cost. This scheme did not strike me very favorably in cases where the pipe is entirely exposed—a bridge crossing, for instance.

The best non-conductors make a loss in any event—some more and some less. Prof. Ordway's tests show that cotton and wool wadding make the least loss, while an air space pure and simple, or asbestos, rank very low, not much better than sand. Asbestos is a mineral, fibrous substance, which, when separated, bears a close resemblance to cotton, or perhaps more nearly to silk fiber. Trace it back, and we find it is simply aluminum or clay, but in a different form; and while possessing the property of being non-combustible, probably owes all its non-conducting properties to the confined air held between the fibers. The province of asbestos is simply to protect the more combustible materials, which are the real non-conductors, from being charred or destroyed. Prof. Ordway, in his paper, remarks in regard to asbestos: "Asbestos is commonly supposed to have a wonderful virtue in resisting heat, but there is really no magic power in the mineral fiber. It is a non-conductor only when it is in a light, downy condition, and full of air. It was observed that in those cases in which asbestos paper is put between the pipe and hair felt, the asbestos fails to prevent the scorching of the hair. Incombustibility should not be confounded with non-conducting power. And then, again, experiments Nos. 47 and 50 show that a wrapping of asbestos paper does not insulate so well as the same thickness of mere air. The popular confidence in asbestos partakes of the character of a superstition."

An air space pure and simple ranks low, due to mobility. Prof. Ordway says: "Air alone, as is shown by experiment No. 50 in the tables, transfers much heat when it can move about in a closed space. The usefulness of mere air spaces has been much overestimated, for they can rarely be placed so as to render much service. The air no doubt slides much more freely over smooth particles. It is not unlikely that the great difference between wool and asbestos is largely due to the smoothness of the soapy mineral fiber asbestos. It is hard to conceive of anything better fitted to counteract the mobility of air than the irregular twists of flattened cotton fiber, the crinkles and scaliness of wool, the fringed edges of down filaments, or the feathered angles of snow-like cystals. When more and more organic fiber is crowded into a given space, the thickness of the stratum remaining the same, the transmissive power appears to be diminished till a certain limit is reached, beyond which there comes an increase. Probably, then, the mobility of the air has been brought to a minimum, and the proper conducting power of the fiber begins to act more decidedly."

The Prof. Ordway experiments show that we must look in the direction of cotton and wool fiber for the best non-conductors, but with water pipes it has seemed to me that we must go a step further. We must find some substance or substances in combination that will supply back again the increment of heat lost. With steam, the boiler supplies this. A water main is constantly losing some heat from the water with the very best non-conductor pure and simple, and the only ordinary remedy is a more free circulation to bring new particles of the water into the exposed pipe to be acted upon. Where the circulation is rapid and con-

stant through the whole 24 hours, this plan, in connection with a good non-conductor, fills the bill.

Unfortunately, however, during the hours of the night there is usually very little legitimate consumption, and resort must be had to waste pipes to maintain rapid circulation during the night hours. This means a loss of water, and as it costs money to produce the water in the mains, it is also a financial loss.

The question of spontaneous combustion then suggests itself. Water pipes in the winter, or even at any time, are always at a low temperature, with a certain amount of moisture or sweat on the outside. Spontaneous combustion under these conditions will hardly, if ever, take place; in fact, it may be assumed, never. Again, all chemical changes, even decay, which is a chemical change, produce heat, and I turned my inquiries in this direction. I found that at all the knitting mills there is a waste product called wool waste, being composed partly of wool and cotton fiber; that this waste, due to the process of manufacture, is partly saturated with oils, and when placed in a pile slowly generates heat and finally decays. The best grades are sold to the paper makers and lowest grades thrown away. The best grades vary in price from 1 to 2 cents per pound. This material, then, just fills the required conditions of being, first, the best class of non-conductor of itself, and also having in combination a partial saturation of oil, which promotes decay, hence heat. I determined to use this material as a filling around the water pipes crossing the bridges, and as wood laid with the fibers parallel, and in no case with the ends of the wood at an angle with the pipe, to prevent the mobility of air through the cells of the wood, is a very good non-conductor, as well as a cheap outside covering, I determined to make a box surrounding the pipe of 1½ inch plank, so constructed as to be 6 inches away from the pipe at any point. The top of the box I made roof shape, with an outside top stringer of wood covering the joints of the roof boards on top. Where the side plank join together, I butted the ends and nailed an inside cleat or batten on to cover the air space. The pipe I rested on blocks of wood set about 4 feet apart, filled in the space in the box with the wool waste, tightly rammed in, protecting the outside butts of the side and roof planks with strips of tin nailed close.

I also tapped in two, one half inch wastes, one on each end of the bridge, to be used in case of an excessive cold spell of weather. The bridge coverings have now run about six years, and with perfect success. I used the wastes the first years, but for two seasons past the waste was not opened, and even where there was a very small consumption the water has run free until late this spring, when one of the pipes on a bridge gave out. On examination I found that decay had progressed so far with the wool waste as to render it valueless for the purposes intended. This has taught me the additional lesson that five years is about the lifetime of the effective working of the wool waste non-conductor in connection with water mains.

I have also had another experience with wool waste as a non-conductor and generator of heat protecting water pipes. In the Little Falls water works system there are two series of pressure valves cutting down the pressure from 240 to 140 pounds to the square inch. The valves are the Ross pressure valve, which is essentially a balanced valve or piston with three working disks, and regulated by a small pressure valve, ¾ inch. In very cold weather, if the ¾ pipe should freeze, or a thin film of ice form on the barrel of the valve, it would work badly. To prevent freezing, I placed the first valve set in a house and arranged for a fire during the winter. When it was found desirable, a second feed line was constructed from the distribution reservoir to town. This line was so located of necessity that it was impracticable, without a heavy expense, to place the valve in a house, but a well in the road was the best plan that could be adopted. As the bridges had then worked a year satisfactorily, I designed a well inclosing the pressure valve, and determined to depend upon the wool waste covering the valves, in bulk, for protection, in lieu of a fire. This plan has worked satisfactorily to date. This valve has never frozen, and when the well has been opened in very cold weather the air inside has always been found warmer than the surrounding atmosphere. The wool waste I remove every spring, send it up to the distribution reservoir grounds and bring it back in the fall again, each year adding a little new waste. This scheme has been a perfect success. It is but fair to add that this well is connected to the sewer leading down the hill, and it may be that a portion of the hot air comes from the sewer.

In conclusion, I feel safe in saying that for pipes laid under ground with a partial depth or protection of earth, the Calumet and Hecla mine plan of a protection of plaster of Paris and sawdust, with the addition of a whitewash of cement on the pipe, as also on the outside of the non-conductor, is, in my opinion, the best and cheapest method of construction to provide against freezing, while for bridges or any above ground pipes, a wooden box, filled with wool waste, which is partially saturated with oil, is by far the best protection of which I have any knowledge. It combines both the non conduction and the slow generation of heat. I trust that my researches in this direction may be of service to other members of the American Water Works Association.

Wisconsin's Huge Monolith.

A striking feature of Wisconsin's contributions to the fair will be the great brownstone monolith. This obelisk, which claims the title of being the largest on earth, can trace its conception to a jocular remark made by Frederick Prentice, owner of the large quarries near Ashland, to ex-Gov. Fifield. While conversing on matters relative to monster pillars of stone in the shape of obelisks, Mr. Prentice remarked that he could surpass the largest Egyptian production from among his quarries on the Bayfield shore of Chequamegon Bay, or on one of the numerous Apostle Islands. To Mr. Fifield it hardly seemed feasible, but the earnestness of Mr. Prentice, and his declaration that if the State of Wisconsin would accept and erect the monolith he would deliver it to the State without cost, for a State exhibit at the World's Fair, so impressed Mr. Fifield that he opened communication with the Board of World's Fair Managers. This correspondence, although appearing to the commission to suggest an impossibility, led them to make a visit to Ashland, and, in company with Mr. Prentice, to view the quarries. After looking over the ground they practically accepted Mr. Prentice's generous tender, and agreed to take the stone as soon as it was broken from its bed, and move and erect the same on the grounds to be designated by the fair officials at Chicago. Accordingly work was commenced at once with five steam channelers and about 40 men on August 1 last, since which time the work has been pushed until the large pillar, which was last month successfully broken from its bed, was worked out.

The announcement was made by Mr. Prentice that the monolith would be loosened on Friday, Nov. 18, and on that day the public were invited to the quarry to witness the event.

Previous to the day of raising, the workmen of the quarry had carefully started the parting wedges, so that on the appointed day all that was necessary to complete the task Mr. Prentice had undertaken was the successful driving of the wedges. Along each side of the monolith, which had been sawed at either end, were started about 400 leather wedges, all partly driven.

Arriving at the quarry, all that remained to be done was the giving of the signal to begin driving the wedges. There were 50 men on either side standing with mauls uplifted waiting for the word to be given to tap the entered wedges. At a signal from Mr. Prentice the mauls fell, and the work had begun. With the precision of clockwork the men drove the wedges, at each succeeding blow advancing to the next wedge. At last, with a slight quiver, the huge rock parted in its entirety from the mass and lay at the bottom of the pit ready to be delivered to the State Commission, to be trimmed to the desired size.

Mr. Pentice's first proposition to furnish the monolith was for a stone just a trifle larger than the Egyptian obelisk at Rome, said to be the largest in the world, which is 105 feet 7 inches, exclusive of the foundation, and 9 feet square at the base. He first intended the monolith to be 106 feet in length and 9 feet 2 inches at the base, but upon a later consideration decided to have it 115 feet long, 10 feet at the base, and 4 feet square at the top. The apex will be about 5 feet long and will be tapered to about a 6 inch tip. The entire monolith will rest upon a foundation of granite 10 feet high and 12 feet square.

The Carnegie Natural Gas Contract.

Iron Age says that an announcement was made in Pittsburgh last week that the suit of the Philadelphia Natural Gas Company against the Carnegie Steel Company, Limited, of that city, amounting originally to $767,578, but since increased to $800,000 by additional claims for unpaid gas bills, had been settled to the satisfaction of both parties. It will be remembered that about a year ago the first named Company entered suit for $767,578, claimed to be due for natural gas furnished to the defendants. The Carnegie concern refused to pay the bill on the grounds that they held a perpetual contract with the Philadelphia Natural Gas Company to furnish them gas for their numerous mills at a fixed rate. The Gas Company, upon finding that the consumption of gas for domestic purposes was rapidly increasing, decided that it would be more profitable to look after private consumers from whom they obtained better prices for gas than were secured for rolling mill owners, and notified the defendants that they would cease furnishing them gas

at a certain period. Upon receiving this notice the officials of the Carnegie Steel Company, Limited, entered a counter suit, asking an injunction to restrain the plaintiffs from cutting off their supply of gas, which was granted. While the exact terms at which settlement of the suit were made could not be obtained, it is stated that the suits were withdrawn on condition that the Carnegie Steel Company, Limited, shall pay to the Philadelphia Natural Gas Company all bills for gas furnished since January 1, 1892, and that the Philadelphia Company shall pay to the Carnegie concern an amount between $75,000 and $100,000 as a consideration for the annulment of the contract. This latter sum, it is claimed, will more than offset the sum to be paid by the Carnegie Steel Company, Limited, for gas consumed by them thus far this year. In addition, the Carnegie Steel Company, Limited, will have to pay for the gas used during this year at the same rates charged other manufacturing plants, the annulment of the old contract to date from January 1, 1892. In the last quarterly statement issued by the Philadelphia Company, the amount of the claim against the Carnegie Steel Company, Limited, was fixed at $827,408.40. The wiping out of this amount means a nominal depreciation in the value of the 150,000 shares of stock of the Gas Company of about $5.50 each. It is now announced that the Carnegie Steel Company, Limited, will entirely discard the use of natural gas at their Upper and Lower Union Mills in Pittsburgh, as soon as necessary changes can be made, and coal will be used exclusively. It is claimed that preparations were made some time ago, looking to the displacement of natural gas as fuel, and that the return to coal can be made in 48 hours' time without causing cessation of operations.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

A CORRESPONDENT at Grand Forks, North Dakota, writing to the JOURNAL under date of the 8th inst., says: "The Economic Gas Company, of this city, has nearly completed its works, and expects to turn on gas in a few weeks, very much to the gratification of a large list of customers. The peculiar thing about the enterprise is that the Company is made up entirely of home business men, who have put their money into this enterprise with a view of making the plant the model gas plant of the United States; and, when completed, the works will be entirely free from debt. Is not that doing pretty well for a North Dakota city, of 8,000 people? The works will have an output capacity of 200,000 cubic feet per day, which will amply supply the requirements of the city, for the next decade at least. It is true there is another gas plant in the city, which has hitherto done a good business, but as it is controlled and operated by non-residents, who have been indifferent as to the quality of gas produced, simply operating the plant for what there is 'in it' for themselves, the business element in the city became rebellious and organized the Economic Company. The new Company has already secured a large share of the business and undoubtedly will do a dividend paying trade from the start. As it will have no outstanding indebtedness the profits will accrue immediately to the benefit of the stockholders. All the stock is sold and fully paid up, and from business already secured every holder is assured of realizing handsomely from his investment. The officers of the Company are as follows: President, J. P. Kingsland; Vice-President, George B. Winship; Secretary, E. D. Kingsland; Treasurer, James Twamley; General Manager, Thos. Hennessy."

FROM our correspondent's presentation of the case, who admits that the old Grand Forks Gas and Electric Company has done "a good business," it would seem that the appearance of the Economic Company on the scene was prompted by a desire to divide with the non-residents of the other Company what there "is in" the general gas supply of the city, and not with the sole purpose of practically carrying out the belief that the commerce of a city should pay tribute only to those who are residents thereof. In fact, if the best interests of the public were to be alone considered, that bare fact would prevent an excessive investment of capital to perform that which ministers closely to an important want—their need of cheap artificial lighting. In other words—for no one supposes, much less believes, when the two Companies shall have, through a rate war or otherwise, agreed on a basis of settlement, the capital of either Company will have been materially curtailed—at some future time the people of Grand Forks will, because of the rate they shall have to pay for gas, pay tribute to the two Companies for what there "is in" the business. Again, the people of Grand Forks might do well to remember that they have been served with gas for some time back because of the chances taken by outside capitalists at a period in the history of their city when the home capitalists seemed to be unwilling to take a risk over a gas supply. If, however, the old Company has been blind to its obligation to supply a gas of good quality at a fair price, then that Company has merely courted the opposition that was bound to develop from such a course.

THE following from Mr. Egner, dated at St. Louis on the 7th inst., explains itself: "To the Editor AMERICAN GAS LIGHT JOURNAL: It having come to my knowledge that unauthorized parties have recently quoted me as indorsing gas making apparatus in which they are interested, I would feel obliged to you if you would inform the readers of the JOURNAL that all such reports are untrustworthy, and that any who care to know can always learn the truth in such matters by addressing direct.—Yours truly, FREDERIC EGNER."

THE San Rafael (Cal.) Gas and Electric Light Company announces that it is now prepared to supply gas and arc or incandescent electric lights to the residents.

WE made some reference in our last issue to certain efforts for relief that were being made by Mr. Addicks with reference to that gas affair of his down in Delaware. Supplementing that reference, we reprint the following from the Wilmington *Every Evening*, of the 7th inst.: "At a meeting of the Board of Directors of the Oxy-Hydrogen Company, of Delaware, held at the Company's office in this city on last Saturday morning, the following resolutions were adopted:

"*Resolved*, That the President of this Company is hereby requested and directed to appear before the Directors of the Street and Sewer Department of the city of Wilmington, Del., and ask that they withdraw their application to the courts for an injunction to prevent the Oxy-Hydrogen Company from opening the streets of Wilmington for the purpose of laying gas pipes, the object of the request being to obviate the necessity of a suit for damages against the city of Wilmington and others.

"*Resolved*, That the President be authorized to pledge this Board that they will consult the said department from time to time before opening any streets." In compliance with this action of the Directors of the Oxy-Hydrogen Company, a certain member of the bar whose name is withheld, because, in response to an inquiry from *Every Evening*, he denies that he has been retained as counsel by the Oxy-Hydrogen Company, adding that "he only wishes the lightning would strike him," is reported to have brought about a private conference between the representatives of the Oxy-Hydrogen Company and the Directors of the Street and Sewer Department. This meeting was held last Monday afternoon. No one was present thereat but the members of the Street and Sewer Department, Mr. J. Edward Addicks, Mr. John G. Baker and the lawyer referred to. At this meeting the above resolutions were presented, and the withdrawal of the injunction advocated at length by Mr. Addicks. Of course, the department took no action in the premises. It was expected that the resolutions might be brought up at last night's regular meeting of the Street and Sewer Department, but nothing was said about them. The injunction referred to was laid in April, 1891, and no rejoinder to the same has yet been filed by the Gas Company.

EARLY last week advices were received from Walla Walla, Wash., to the effect that the Walla Walla Gas and Electric Light Company had yet considerable work to do on the new plant before it will be ready for operation. The bad weather has somewhat delayed the progress of the work, but the proprietors expect to have the whole thing completed before Christmas day. The mains are in the ground and the electrical machinery is being installed. The line wiring work, however, is considerably behindhand.

ON the 10th inst. Mr. J. H. Enright, Superintendent of the gas department of the Leavenworth (Kas.) Light and Heating Company, handed in his resignation, the same to take effect on the appointment of his successor. We do not know the inciting cause for this resignation, but we do know that Mr. Enright has served the Company acceptably for a period of 13 years. For 10 years he was Assistant Superintendent under Mr. John Gimper, and succeeded to the Superintendency on the resignation of the last-named gentleman.

THE Berlin Iron Bridge Company, of East Berlin, Conn., has been awarded the contract for three new iron buildings, to be covered with iron roofs, the same to be erected on the premises of the East River Gas Company, Ravenswood, Long Island.

WE understand that the plants of the Nevada (Mo.) Gas and Electric Light Company were sold, on the afternoon of the 7th inst., under the

mortgage held by the Missouri, Kansas and Texas Trust Company, and the properties were bought in by the Trust Company for $5,000 over the mortgage. Since August, 1891, the works, which are in fairly good condition, have been operated by a receiver—Mr. John P. Lowery—and the business has been good. We have not been advised as to the disposition the purchasers intend to make of the property.

THE electric lighting plant at Raton, New Mexico, was sold at auction some days ago to satisfy a judgment of $2,000 against it held by the local First National Bank. It was bought in by the Manager, Mr. Fred. Brueggeman.

MR. HERBERT H. WALKER, for many years an office employee in the service of the Holmes, Booth & Hayden Company, has, on the advice of Mr. A. M. Young, of Waterbury, Conn., who is President of the Rockville (Conn.) Gas Company, accepted the position of General Manager to the latter corporation.

WRITING of Rockville matters brings to mind the fact that, on the 6th inst., the annual city meeting was held, a large attendance of the taxpayers—perhaps the largest attendance in the history of the city—attesting the interest that was taken in the matters to be decided. About the first thing to come up for discussion was the proposition to determine whether or not the city would vote an appropriation of $25,000 for the installation of an electric lighting plant, to be operated on city account, Not much time was wasted over the matter, for, on motion of Mr. G. N. Brigham, it was voted to indefinitely postpone the whole thing. In other words, that settles it, and all the Roberts' rules of order that ever were printed would fail to change the action taken.

THE authority from whom the above was received adds: "The Rockville Gas Company is placing its plant in the best possible condition. The buildings have been thoroughly repaired and are now being painted. The Company hopes to have the incandescent plant in operation by January 1st. Twenty miles of wire are now being strung, and the dynamos will be received in a few days. The Company proposes to give the best arc and incandescent service possible."

SOME time ago Professor Hobbs, who is testing in a desultory way the gas meters of the Cleveland Company, reported what he thought was a queer find in the shape of a fast and slow gas measurer in the residence of a consumer on Wolcott avenue. The meter, according to the Professor, showed 4 per cent. fast, when three burners were lighted, but it showed 6 per cent. slow when 6 burners were getting a supply from it. We do not know how the Professor reached these results, but we do know that the Wolcott avenue resident was positive that "ordinarily" the number of burners going in his house was 3. We also know, however, that the Gas Company put in a new meter.

THE public lighting of Milburn, N. J., by means of gas lamps, is now an accomplished fact. The lamps so far placed number 125.

O. M. ALLEN and others have organized an opposition Gas Company at Kalamazoo, Mich. It is capitalized in $200,000. It looks to be a strike.

MANAGER JOHN TRACY, of the Poughkeepsie (N. Y.) Gas Company, is preparing to pay his respects to an itinerant gas meter inspector, who proposes to try the old game of tricking the "indignant gas consumer" out of his superfluous half dollars.

THE following resolution was recently adopted by the Common Council, of Auburn, N. Y.: "*Resolved*, That the City Attorney be and he is hereby directed to prepare and present to this Council, at the next regular meeting, a franchise giving and granting to the Peoples Gas Light Company the right to manufacture gas for lighting the streets, avenues, lanes, parks and public buildings in the city of Auburn, and also giving to said Company the right to excavate the streets and public places in said city for the purpose of laying pipes, etc." Ald. Nelson offered the resolution, and there was but one vote against it, that of Ald. Hanlon. Of course, the final adoption of the matter seems to be a long way off, and it is to be hoped that it will never receive the sanction of the authorities; but, whether so or not, the proceeding has a very bad appearance, for the city needs another Gas Company about as much as the average porcupine needs another quill.

IT is reported that the plant and franchises of the Mechanicsburg (Pa.) Gas Company have been sold to New York capitalists. We hope they intend to rebuild the plant.

OUR small "ads." in this issue are well worth examining carefully, and the tenor of one of them is, to say the least, unmistakable. This "ad.," which bears the signature of "Gas Works," offers for sale almost 95 per cent. of the stock in a gas works that, apart from the pleasing fact that the plant is located "in a beautiful, healthy and growing city," that it is "handsomely paying," that the "property is in excellent condition," and that its "business is healthily increasing," also has the advantage of not having "an electric annex." Evidently the advertiser sets much store upon this latter state of things as increasing the value of that which he has for sale—a gas works only. Another "ad." is that signed by Mr. O. T. Boaz, President of the Pittsburg (Kas.) Gas Light and Coke Company, who offers for sale the entire belongings of the Company. This Company, however, is the possessor of an electric lighting annex, and President Boaz does not speak of that ownership as in any way affecting, either for better or worse, the value of the property as a whole. Still another "ad." is that published at the instance of the executors of the estate of Mr. William Voorhis, who, on the 27th inst., will offer for sale, at public auction in Nyack, N. Y., the plant and properties of the Nyack and Warren Gas Light Company. This plant and franchise ought to be a purchase at anything like a fair figure, for with a reasonable expenditure of capital and energy the sendout of the Company could be trebled. The district is growing, and when the West Shore Railroad is operated with a view to developing and caring for its local traffic, the district supplied by the Nyack and Warren Company will be well worth catering to. The purchasers will require some faith along with their capital, but it looks to us to be worth risking.

SUPERINTENDENT J. E. SHATZER, of the Hollidaysburg (Pa.) Gas Company, is putting in the Sutherland process, under the direction of the inventor, Mr. A. M. Sutherland. This construction is to replace a sample of the Brooks process, and it is to be hoped that the Hollidaysburg folks will now find their way out of the woods.

MANAGER BENNETT, of the Freehold (N. J.) Gas Light Company, has succeeded in placing another gas engine in the heart of Monmouth county. It is a 2 horse power engine of the Otto type, and was placed in the printing shops of the Monmouth *Inquirer*.

THE Committee on Light of the Manchester (Va.) City Council recently asked for and obtained an extension of time in which to further examine into the matter of the merits of the process of gas making that the proprietors of the Southern Fuel and Gas Company propose to employ in supplying gas to the residents, provided the Council eventually issues a franchise to them.

THE Select and Common Councils of Philadelphia have authorized the Director of the Department of Public Works to largely extend the city's system of gas mains.

A CORRESPONDENT at Burlington, Iowa, forwards the following: "A suit (No. 2,439) entitled the Burlington Gas Light Company versus the Burlington, Cedar Rapids and Northern Railroad Company, has been filed in the local District Court, by Messrs. Smyth, Rumple & Lake, attorneys for the plaintiff. The petition asks for an injunction against the Railroad Company to prevent it from cutting down the grade of Front street and building a new freight house opposite the gas works, and iterates that the plaintiff is owner of lots 66, 67, 68, 69 and 70 on Front street, between Arch and High streets; that Front street extends from said lots to the river, and was reserved by Congress many years ago for public use; that defendant is engaged in changing the actual physical grade of the street many feet, by cutting down in front of plaintiff's property, so as to render access to said property very difficult; that defendant is acting without having proceeded in any manner by law to change said grade; and without paying or proposing to pay anything as damages to parties injured thereby; that defendant is about to erect large buildings on said government land, to the great and irreparable damage of the plaintiff; wherefore plaintiff asks for an injunction restraining defendant from doing said grading, etc., and for damages. The suit was not a surprise, though it was not seriously anticipated that this complication would arise in the matter of the proposed erection of the freight house by the Burlington, Cedar Rapids and Northern Railroad. The consent of the city had been obtained at a recent session of the City Council, and elaborate plans had been perfected for the erection of a large, commodious freight house almost west of the location of the present one. As the Railroad Company has entered into an understanding with the city to hold it harmless, the municipality will not be affected by these proceedings. The fact, however, that such an agreement was entered into goes a long way to show that the city was far

from sure that its permission to the Railroad Company was free from criticism, and so goes to prove that the plaintiffs have something tangible te begin with in the long drawn out legal contest that is sure to follow."

THE proprietors of the Coatsville (Pa.) Gas Company have announced a reduction in the gas rate to $1.70 per 1,000 feet, the same to date from the 1st inst.

THE following are the bids submitted by the different Gas Companies for the public lighting of the city for the year 1893:

Name of Company.	Rate per Lamp.
Consolidated Gas Company	$17 50
New York Mutual "	17 50
Equitable "	12 00
Standard "	13 04½
Central "	27 00
Northern "	28 00
Yonkers "	28 00
New York and New Jersey Globe (naphtha lamps).	22 00

The bids submitted by the electric lighting companies were as follows:

Company.	No. Arcs.	Rate per Arc per Night.
United States Illuminating Co	351	40 cents.
" " "	17	50 "
Brush Company	72	45 "
" "	42	50 "
" "	229	40 "
Thomson Houston Company	277	40 "
" "	45	50 "
Mount Morris Company	314	40 "
Harlem Company	194	40 "
" "	19	50 "
Edison Company (5th Avenue)	(double lamps)	50 "
Manhattan Company	52	40 "
" "	17	50 "
North River Company	553	45 "

The bids were referred to Mr. McCormick, Superintendent of the Bureau of Lamps and Gas, for tabulation.

ELSEWHERE we refer to the incorporation of the Citizens Gas and Fuel Company, at Kalamazoo, Mich., and in further mention thereof we append the names of the officers chosen: President, O. M. Allen, Sr.; Vice-President, J. W. Osborn; Secretary, Frank Henderson.

THE authorities of Richmond, Va., have finally assented to the proposition to install an auxiliary water gas plant at the city gas works. It is to be capable of putting out 600,000 cubic feet per diem, and the plans also call for the construction of a relief holder of a capacity of 40,000 cubic feet.

AT a special meeting of the Board of Directors of the Citizens Gas Light Company, of Buffalo, N.Y., the following resolutions, respecting the late Mr. Sylvester F. Egan, a member of the Board, were adopted: "Sylvester F. Egan has been for many years a member of this Board. During all this period he was a faithful Director. Few men were given clearer perceptions, a quicker comprehension or keener sense of justice and right than our lamented associate. He was a man of clear vision. He was never confused or confusing. Rapidly grasping the circumstances of any case, his mind came at once to a wise conclusion. He united with those powers a kindliness of demeanor, an unassuming manner, and a courtesy born of a pure heart, which made his personal relations with his business associates peculiarly close and valuable. He was a model Director. Every duty imposed upon him by his office was scrupulously performed. He gave the same attention to every matter of the Company confided to his care which he bestowed upon his own private concerns. In all things he tried to do his duty and his whole duty. To his afflicted wife and children this Board tenders its deepest sympathy, and as a last tribute of respect it resolves that it will attend the funeral in a body."

MESSRS. F. J. DAVIS and F. W. Thomas, of Boston; C. M. Coburn and Thos. Heintz, of Chelsea; W. A. Leonard, of Newton; Wm. Anderson, of East Boston; G. D. Bill, of Malden, and C. H. Spaulding, of Waltham, recently paid a visit to Holyoke, Mass., for the purpose of inspecting the new gas plant in that city. They were received and entertained by Superintendent William H. Snow, and it was the unanimous opinion that Mr. Snow was now in charge of a gas plant that would be up to the gas demands of the busy city of whose industries it is a worthy representative.

THE proprietors of the Ware (Mass.) Gas Company have ordered a cut in the gas rate of 25 cents per 1,000 cubic feet. The new rate, which is to apply to all gas consumed from the 1st inst., is $2 per 1,000.

ABOUT a fortnight ago, at a meeting of the Columbus (O.) Board of Trade, Mr. Trauger called attention to the fact that the Committees on Gas and Light and Judiciary had not made any report on his resolution requesting them to inquire into the advisability and practicability of the city establishing and maintaining an electric light plant. The demand, he said, for some change in the present system of lighting the city was daily becoming more apparent. There was no question but the city could light its streets cheaper and more satisfactorily than by contract with a corporation, and he was ready to furnish facts and figures proving it at any time. Complaints were made by a number of members of the fact that just now the streets were not lighted early in the evening nor late in the morning. Some outlying portions of the city he claimed were dark part of the time the year round. Without further debate, the named Committees were instructed to report back the Trauger resolution at an early date.

FROM two or three different sources we were informed that the works of the Dayton (O.) Gas Light and Coke Company were badly damaged by fire, towards the close of November. In order to allay the apprehensions of our informants, and as a bit of news "to all whom it may concern," we can state authoritatively that the damage done did not amount to $350. At one time, however, the fire did look quite threatening.

THE trolley system of propelling surface railroad cars in Boston has caused much damage to the water and gas mains of the Cambridge district. The return wire (the single trolley system is in vogue in Cambridge) is charged with being the offender.

A CORRESPONDENT at Bradford, England, forwards the following items: The electric lighting installation of the Great Northern Hotel, Bradford, consists of about 600 lights of 32, 16 and 8 candle power, fed from the corporation supply at 115 volts. The wiring of the hotel is carried out entirely on the sub circuit distribution plan. Two pairs of heavy main cables are carried up the side of the hoist, and from these are run branch cables to the distributing boards on each floor. On these distributing boards are fixed the double pole sub-circuit cut-outs of 10 amperes each. The casings to carry the wires to the various rooms are run on the corridor walls on the under side of the mouldings, and are hardly noticeable. When a branch wire is taken through a wall to a bedroom, a fuse is fixed in the casing in the corridor, and the wires in the bedrooms are carried in casings on which an ornamental picture mould is screwed, 18 inches from the ceiling, forming the limit of the frieze. The whole of the installation was carried out by Messrs. Woodhouse and Rawson.

REFERRING to the state of the gas coal trade of Scotland we are told that the producers of gas coal are talking of restricting production, as at all the leading collieries, where the finer qualities of cannel are worked, the stocks are accumulating to a discomforting extent. Consumers are mostly confining their attention to the second and third class qualities, and some are using splint coal. Shale for gas making is also pressed on the market, and now commands $2.68 per ton on the average, which is from 50 cents to 62½ cents down from the price of last year. The production of shale has largely increased of late, and some qualities are very inferior, and their presence on the market naturally has a depressing effect. At the meeting of the Edinburgh and Leith Gas Commission on November 28, a letter was read from the Rosewell Gas Coal Company, offering to supply the Commission with a large quantity of cannel coal at $5.20 per ton. The Company pointed out that they had supplied the Commission with the same coal last year at $7.50, and afterwards to other parties at $8.75 per ton. Bailie Archibald, Leith, thought if the Commissioners were in need of coal, this was a rare opportunity for them to buy, and he thought they could not do better than remit the matter to the Works Committee to deal with. That was agreed to.

THE proprietors of the Englewood (N. J.) Gas Light Company will extend their system of street mains to the outlying town of Tenafly.

THE Archer Process manipulators are proposing to take a try at fuel gas supply in Port Huron, Mich. They will, it is said, use the mains of the defunct natural gas company.

The Market for Gas Securities.

The market for city gas shares was quiet and restricted during the week, Consolidated showing some unevenness. To-day (Friday) the opening was made at 123¼ to 123½, but the offerings were light. Equitable remains steady at 167 bid, and Mutual shows no change. Standard, particularly the preferred, is constantly inquired after, and holders are talking now of par for it. If the faith that is in them is well founded, and we are of the opinion that it is, the common ought to be a purchase.

The Brooklyn situation is more chaotic than ever. They are all talking syndicates there—no less than four financial Richmonds being said to be in the field. Mr. Addicks is said to have offered 127 for control in the Metropolitan, but it seems to us that the concern which he really needs in the south-central part of the city is the Fulton-Municipal; and if Metropolitan stock is worth 127 to him, General Jourdan's Company's shares ought to be worth at least 210. In the meantime, the Equity Company becomes more of a factor in the preliminaries than ever, and the increase in the value of its shares seems to point to the fact that others are beginning to look at things in the right light. All Brooklyn gas shares were buoyant during the week, but so far as actual advance in the consolidation scheme is concerned the outcome since last Friday has been virtually nothing. Chicago gas is dull, and Baltimore Consolidated is a trifle stronger. Bay State securities are neglected. We note a sale at auction of 7 shares of Jersey City gas at 185. There is much disturbance in the money market to day, but the stringency has a very artificial appearance.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 Wall St., New York City.

December 19.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	123¼	123½
Central	500,000	50	90	95
" Scrip	220,000	—	—	100
Equitable	4,000,000	100	167	170
" Bonds	1,000,000	—	106	108
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	110	115
Mutual	3,500,000	100	142	—
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern	.....	50	—	—
" Bonds	150,000	—	—	100
Standard Gas Co—				
Common Stock	5,000,000	100	35	40
Preferred	5,000,000	100	89	91
Yonkers		50	112	—
Richmond Co., S. I.	346,000	50	—	—
" Bonds	20,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	140	—
Citizens	1,200,000	20	113	113¾
" S. F. Bonds	320,000	1000	—	103
Equity Gas Light Co.	2,000,000	100	43	—
Bonds	1,000,000	—	70	—
Fulton Municipal	3,000,000	100	—	150
" Bonds	300,000		102	—
Peoples	1,000,000	10	98	—
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	100	—
Metropolitan	870,000	100	122	—
" Bonds (5's)	70,000	—	100	—
Nassau	1,000,000	25	160	—
" Ctfs	700,000	1000	99	100
Williamsburgh	1,000,000	50	145	—
" Bonds	1,000,000	—	107	110
Out of Town Gas Companies.				
Boston United Gas Co.—				
1st Series S.F. Trust	7,000,000	1000	88½	88¾
2d " " "	3,000,000	1000	77½	78
Bay State Gas Co.—				
Stock	5,000,000	50	56	57
Income Bonds	2,000,000	1000	77	78
Buffalo Mutual, N. Y.	750,000	100	110	—
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	155	160
Chicago Gas Company.	25,000,000	100	92	92½
Chicago Gas Light & Coke Co.—				
G't'd Gold Bonds	7,650,000	1000	85	90½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1000	—	101
People's Gas and Coke Co., Chicago—				
1st Mortgage	2,100,000	1000	105	—
2d "	2,500,000	1000	104	105
Consumers Gas Light Co., Jersey City	2,000,000	100	20	—
Bonds	600,000	1000	80	—
Cincinnati G. & C. Co.	7,000,000	100	192	—
Consumers Toronto	1,600,000	50	190	191
Central, S. F., Cal.			90	—
Capital, Sacramento, Cal			55	—
Consolidated, Balt.	11,000,000	100	58¾	59
" Bonds	6,400,000		107	107½

EXECUTOR'S SALE,

TO CLOSE THE ESTATE OF WM. VOORHIS, DECEASED.

The undersigned, Executors, etc., of William Voorhis, deceased, will sell at Public Auction, at the Hotel St. George, kept by George Bardin, on Burd Street, in the village of Nyack, on Tuesday, Dec. 27, 1892, at 10 o'clock in the forenoon, all the plant and properties lately of the

NYACK AND WARREN GAS LIGHT COMPANY,

consisting of a lot of land and premises situate upon the easterly side of Gedney Street, in the village of Nyack, about 84 ft. in width front and rear, and 130 ft. in depth, with the buildings thereon; together with all the boilers, engines, pumps, gas benches, holders, street mains, meters, connections, coal, oil, tools, implements, etc., etc., etc.

Terms made known on day of sale.

Dated Nyack, N.Y., Dec. 10, 1892. W. L. VOORHIS, A. M. VOORHIS, D. H. CLOSE, Executors.

915-2

Valuable Gas Property For Sale.

The owner will sell 945 shares out of 1,000, par value of 100, of the Capital Stock of a handsomely paying

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Property is in excellent condition, and business healthily increasing. Has no electric annex. Could not be replaced for much more than will be accepted for it. Charter and Franchise over 40 years to run. No opposition.

Principals only will be entertained, so middlemen might as well give this no attention, for it is a bona-fide proposition for a rare investment.

Process men, stay away. It cannot be bought for Bonds, and it will be useless to talk about absorption.

For full particulars and detail information call on or address "GAS WORKS,"
No. 8 Rookery Rotunda, Ground Floor,
La Salle and Adams Streets, Chicago.

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THE PROPERTY of the PITTSBURG GAS LIGHT AND COKE CO., of Pittsburg, Kansas,

including Electric Light and Power Plant. For further information inquire of O. T. BOAZ,
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POSITION WANTED

As Superintendent of Gas Works.

By a practical man of over 20 years' experience, who is not afraid to work. Could take charge immediately. A reasonable salary expected, and advertiser is willing to earn it. Good references given and required. Address
903-tf "C." care this Journal.

Position Wanted

As Manager or Superintendent of Gas Works,

By a practical man of 15 years' experience in all branches of the business. Now 35 years old, and a pusher. Good references given. Address
910-8 "D.," care this Journal.

PROPOSALS

FOR AN

Electric Light Franchise.

Du Quoin, Ill., Dec. 3, 1892.

Proposals for an Electric Light Franchise will be received by the undersigned at his office, up to 12 o'clock, noon, January the 6th, 1893, in accordance with Sec. No. 10 of Ordinance No. 96 of the City of Du Quoin, Ills., which is as follows:

"And it is further agreed with the said John R. Truesdale, his successors or assigns, that, if the said city or its inhabitants shall desire electricity for light or other purposes, the said John R. Truesdale, his successors or assigns, shall have the exclusive right to establish and operate a plant for such purpose or purposes, provided, always, he or they will furnish such electricity upon as favorable terms or conditions as may be offered by other responsible competing persons or companies. And in case he or they will not furnish it, then the city may grant the exclusive right to do so to other persons, companies or corporation"

Each proposal shall stipulate the maximum price to be charged private consumers, also the city, for both arc and incandescent lights; and no proposal will be considered unless accompanied with a $5,000.00 bond, or certified check, to guarantee the fulfillment of the franchise to be granted.

The city reserves the right to reject any and all proposals. The term for which the franchise will run will be until Sept. 17th, 1900.

(Signed) F. V. NETTLETON,
914-5 City Clerk.

THE GAS WORKS CONSTRUCTION CO.

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LAYING of CAST or WROUGHT IRON STREET MAINS.

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Proposals for Coal Tar.

THE LEBANON GAS COMPANY will receive bids for their **Tar Product of 1893**—making gas under the old process, from best gas coal. Two hundred and fifty (250) bbls. will be about the amount of the product. Bids will be opened Jan. 2, 1893. JOHN M. MISH, Treas.

LEBANON, PA., Dec. 1, 1892.

MOSES G. WILDER, MECH. ENGR.

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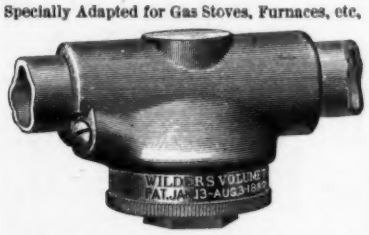

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Correspondence Solicited with all who require a Reliable Governor.

DIVIDEND NOTICE.

STANDARD GAS LIGHT CO. OF THE CITY OF NEW YORK,
71 BROADWAY, NEW YORK, Dec. 2, 1892.

The Board of Directors have this day declared a dividend of one (1) per cent. on the Preferred Stock of this Company, payable on Jan. 3d, 1893, to stockholders of record at 3 o'clock P.M., Dec. 21st, 1892.

Transfer books will be closed from 3 o'clock P.M., Dec. 21st, 1892, to 10 o'clock A.M., Jan. 4th, 1893.

FERDINAND McKEIGE,
914-4 Secretary.

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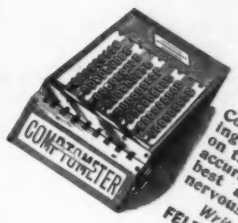

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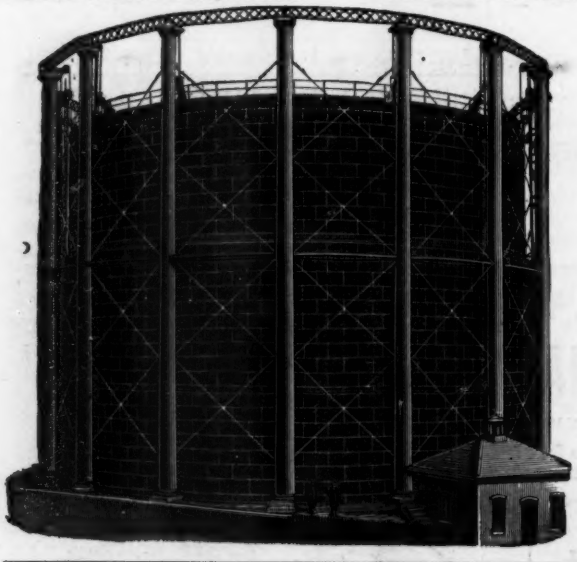

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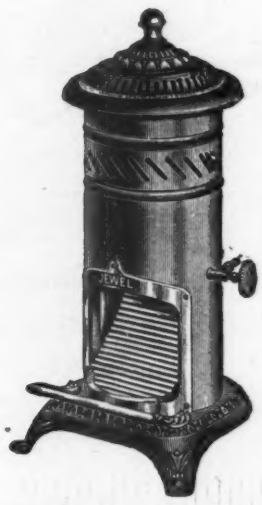

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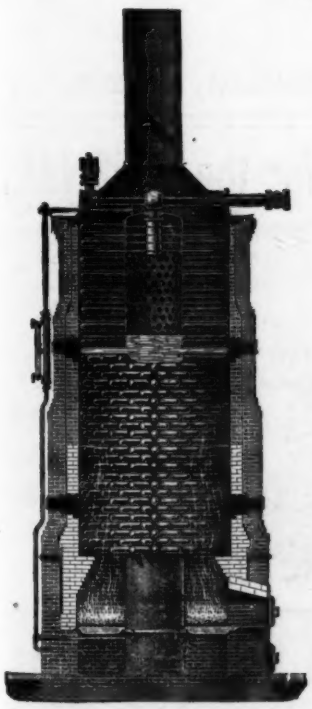

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CONSOLIDATED GAS COMPANY.....New York City.
CONSOLIDATED GAS AND ELECTRIC COMPANY.....Port Chester N. Y.
HUDSON COUNTY GAS LIGHT COMPANY.....Hoboken, N. J.
HAVERHILL GAS COMPANY.....Haverhill, Mass.
ST. PAUL GAS LIGHT COMPANY.....St. Paul, Minn.
NEWARK GAS LIGHT COMPANY.....Newark, N. J.
THE NORTHERN GAS LIGHT COMPANY.....New York City.
NASSAU GAS LIGHT COMPANY.....Brooklyn, N. Y.
MILWAUKEE GAS LIGHT COMPANY.....Milwaukee, Wis.
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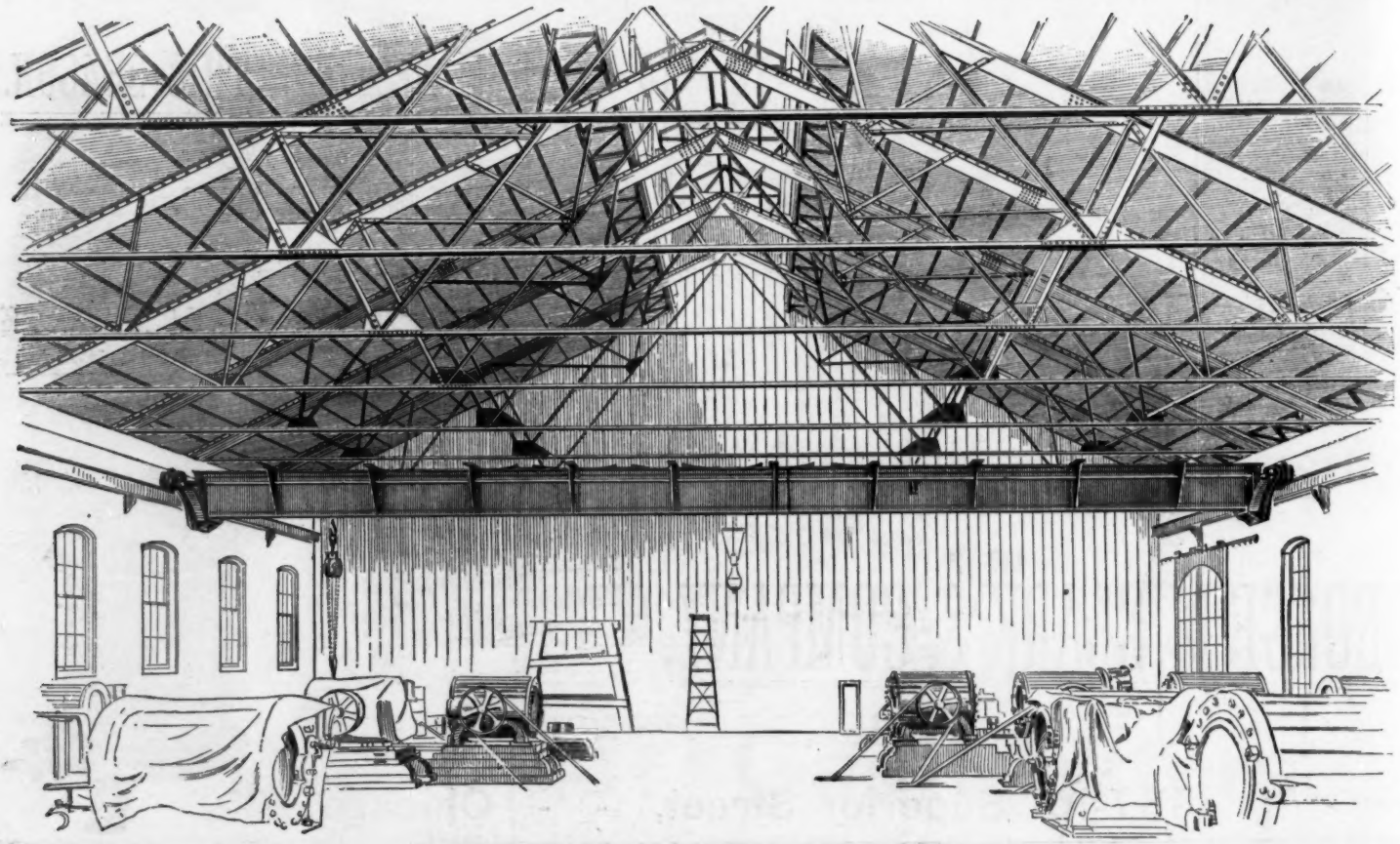

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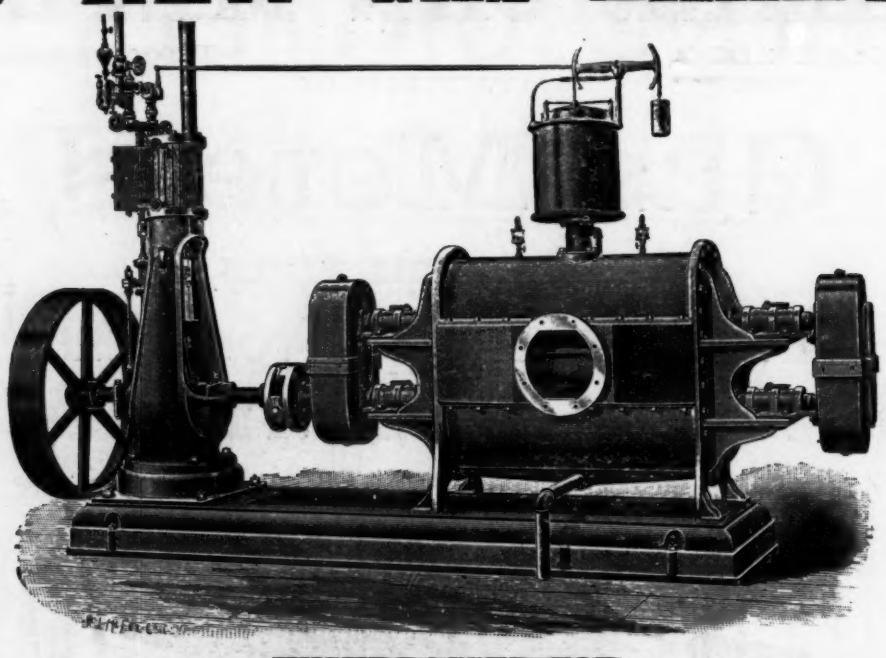

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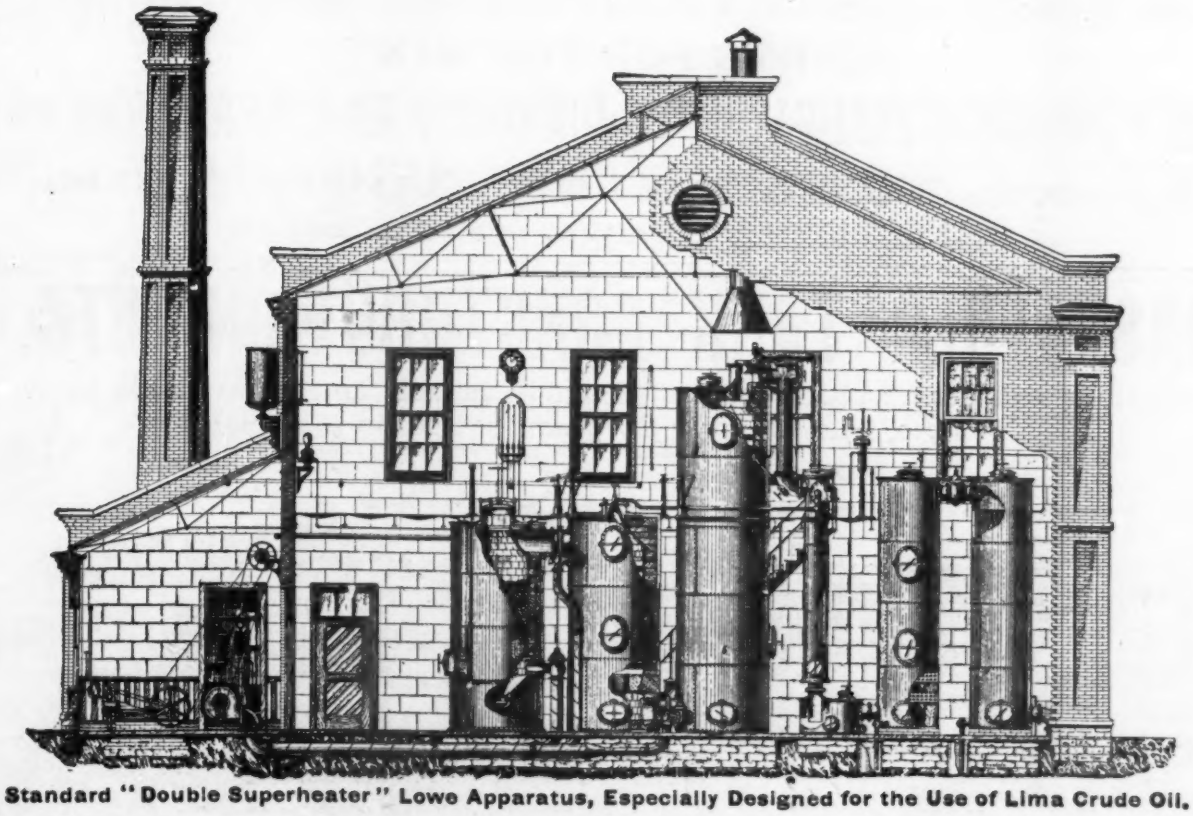

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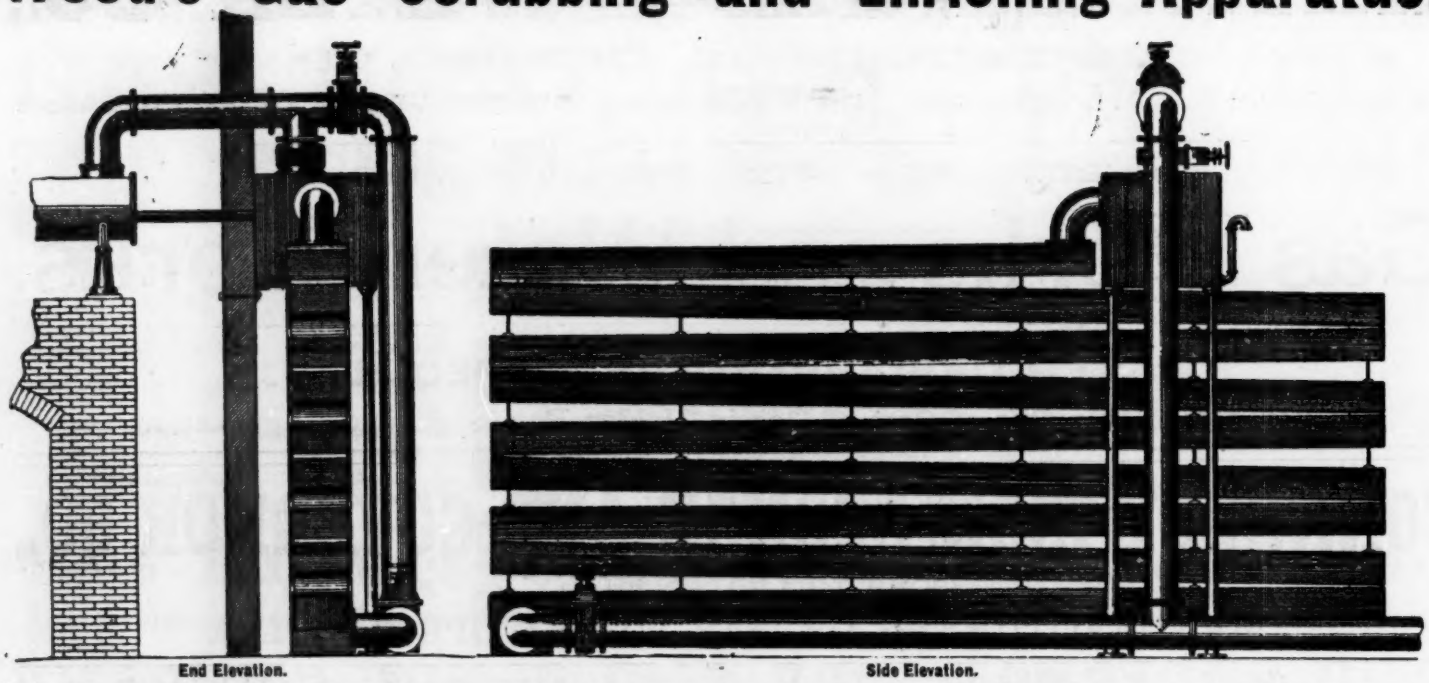

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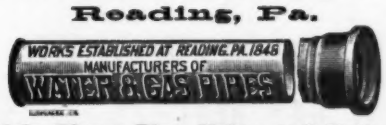

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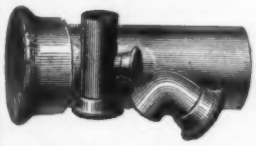

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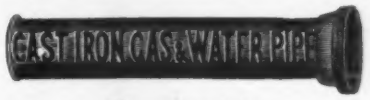

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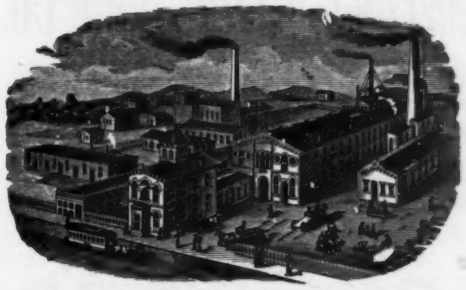

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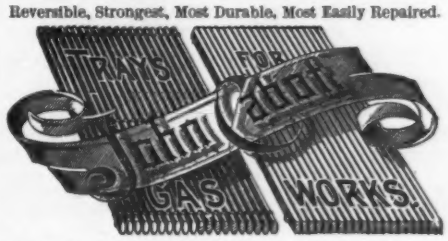

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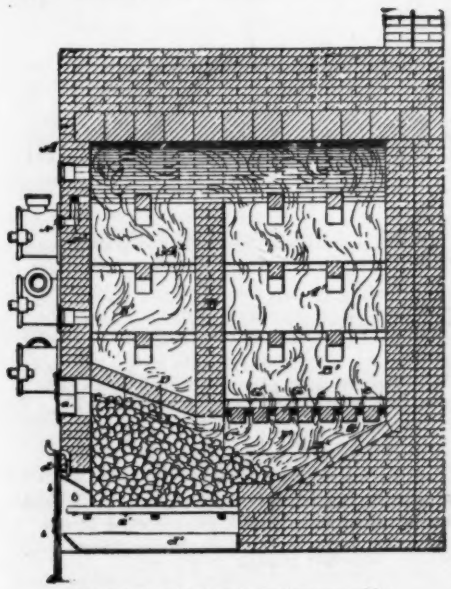

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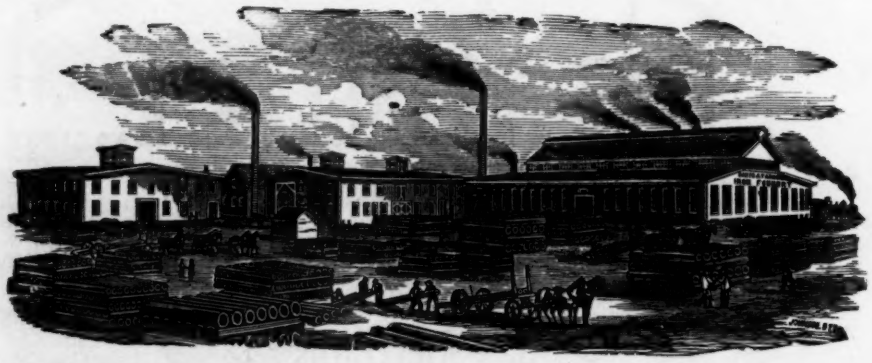

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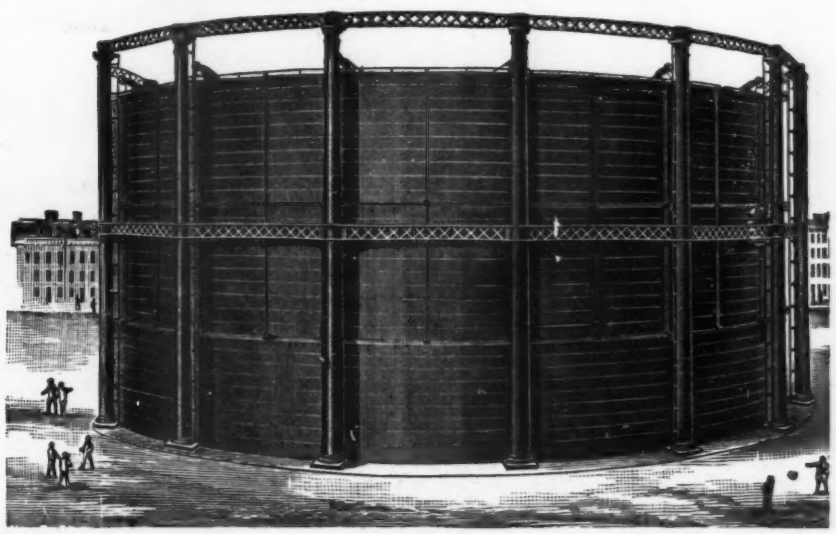

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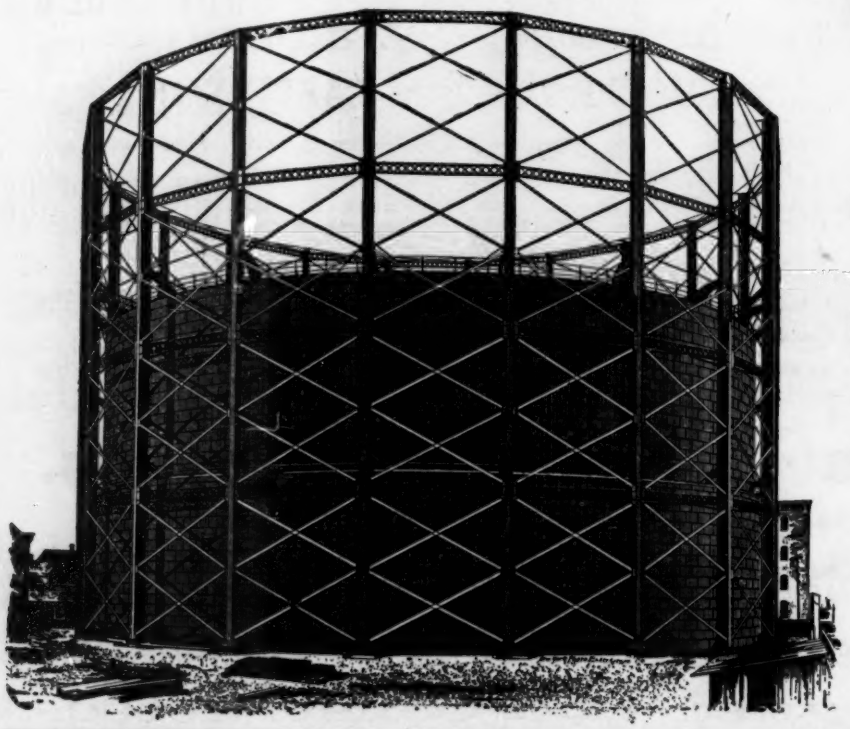

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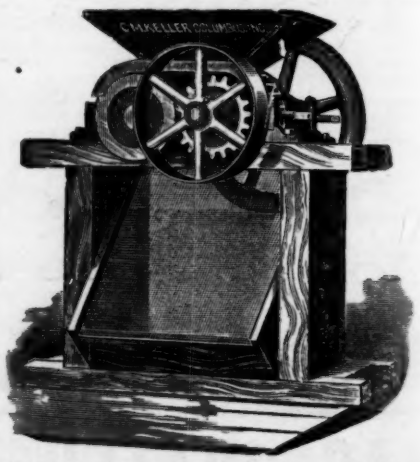

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